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CONTENTS

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MONTHLY WEATHER REVIEW

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COMPILATION AND SUMMARY OF THE EVAPORATION RECORDS OF THE BUREAU OF PLANT INDUSTRY, U.S. DEPARTMENT OF AGRICULTURE, 1921–32

By ROBERT E. HORTON and JOHN S. COLE

The MONTHLY WEATHER REVIEW, October 1921, volume 49, pages 553–566, contains tables of monthly evaporation at stations maintained by the United States Bureau of Plant Industry from the beginning of the records (1907 or later) to 1920, inclusive. Most of the records have been continued down to the present time, 1934. The records for 1921–32, inclusive, have been furnished for publication by William A. Taylor, then Chief, Bureau of Plant Industry, United States Department of Agriculture. A transcript was made from the original records on file in the Bureau by Mr. John S. Cole, and the data have been arranged in form for publication, the means computed and the accompanying discussion prepared, by Robert E. Horton.

A list of all the stations at which evaporation records have been maintained is given in table 1.

Table 2 contains records of monthly evaporation at the different stations maintained during the period 1921–32 or portions thereof, and the monthly means of air temperature, wind velocity, and vapor pressure. These quantities are designated Θ_a, W, and V, respectively. The observed evaporation in inches per month is designated E_O.

During the period 1921 to 1932, inclusive, all the evaporation pans, circular, were 6 feet in diameter and 24 inches deep, buried 20 inches in the soil and kept filled with water to the soil-surface level or 4 inches below the rim of the pan. The anemometer cups were in general 20 inches above the rim of the pan or 24 inches above ground.

The mean air temperatures were obtained by taking the average of the maximum and minimum readings of thermometers exposed 4 feet above ground in standard instrument shelters.

The vapor pressures were obtained by averaging the results derived from psychrometer readings at 7 a.m., 1 p.m., and 5 p.m. Temperature, evaporation, and anemometer readings were taken at about 7 a.m. and recorded as of the previous day. The instructions required that grass be kept cut and other obstructions removed from the vicinity of the evaporation pans so as to permit free wind movement close to the water surface.

Table 3 shows the total evaporation for the 6 months, April to September, inclusive, of each year, for each station. Most of the records are complete for the 15-year period, 1917 to 1931, inclusive. During this interval all the evaporation pans were 6 feet in diameter. The averages of the data for this period are given for each station on the summary sheets. These averages are homogeneous in duration and condition and afford a reliable basis of comparison of evaporation at the different stations. In cases where the record is not complete for this period it has been extended, as indicated by footnotes, by Fournie's method, i.e., the ratio of the evaporation for the period of record to the evaporation for the same period at an adjacent station for which the entire record was determined. The evaporation for the 15-year period at the station of comparison was multiplied by this ratio. Where data were available, three such determinations were made, and the average of the three is the figure set down as the mean evaporation at the observation station for the 15-year period.

In many cases the records are complete for the 20-year period, 1913–32, and the means for this period are also given where available. These 20-year averages are not, however, altogether homogeneous, as pans 8 feet in diameter were used in the earlier years at some stations.

Vapor emitted near the windward edge of a freely exposed water surface is transported horizontally by wind action, and thus the vapor pressure increased, and the evaporation rate reduced, from windward to leeward. This effect probably approaches a limit as the size of the water surface increases. Some reduction in evaporation depth in an 8-foot as compared with a 6-foot pan undoubtedly occurs, due to this cause, when there is equal freedom of wind action on both. The pans were not, however, dimensionally similar, since the rim depth was the same for the 6-foot and 8-foot pans. There was, therefore, apparently a greater portion of the 8-foot pans freely exposed to wind action than of the 6-foot pans.

The only direct observational data available for comparison of the evaporation from 8-foot and 6-foot pans are contained in a letter (dated Washington, D.C., May 10, 1921) from Mr. J. O. Belz of the Office of Biophysical Investigations, Bureau of Plant Industry, United States Department of Agriculture. Mr. Belz stated: "A comparison of the evaporation from tanks 6 feet and 8 feet in diameter, side by side, made at the Amarillo station for 9 years, showed a mean difference per square foot of surface of 2¼ percent, the 6-foot tank giving the higher evaporation."

In the publication of the earlier records water surface temperature data were included for many of the stations. However, all records of water surface temperature at these stations were discontinued prior to 1917.

TABLE 1.—*United States Bureau of Plant Industry evaporation records*

Station	Record available	Record years used	Latitude (approximate) °	′	Elevation above sea level	Diameter of pan: 8-foot beginning—	Diameter of pan: 6-foot beginning—
			°	′	*Feet*		
1. Aberdeen, Idaho	1913–20	1920	42	40	4,400	....	1913
2. Akron, Colo	1909–32	1921–32	40	40	4,650	1909	1916
3. Amarillo, Tex	1908–19	....	35	20	3,676	1908	1910
4. Archer, Wyo	1914–32	1921–32	41	00	6,012	....	1914
5. Ardmore, S.Dak	1913–32	1921–32	43	20	3,557	....	1913
6. Biggs, Calif	1916–32	1920–32	39	00	94	....	1916
7. Big Springs, Tex	1916–32	1921–32	32	00	2,396	....	1916
8. Burns, Oreg	1914–19	....	43	40	4,125	....	1914
9. Chillicothe, Tex	1913–31	1920–31	34	20	1,406	....	1913
10. Colby, Kans	1915–32	1921–32	39	30	3,135	....	1915
11. Crowley, La	1910–31	1920–31	30	15	21	....	1910
12. Dalhart, Tex	1908–32	1921–32	36	20	4,000	1908	1917
13. Dickinson, N.Dak	1909–32	1921–32	47	00	2,543	1909	1917
14. Edgeley, N.Dak	1908–20	....	46	20	1,468	1908	1917
15. Garden City, Kans	1908–32	1921–32	38	00	2,836	1908	1917
16. Havre, Mont	1916–32	1921–32	48	40	2,565	....	1916
17. Hays, Kans	1907–32	1921–32	39	00	2,000	1908	1917
18. Hettinger, N.Dak	1911–21	1921	46	00	2,253	....	1911
19. Lawton, Okla	1916–32	1921–32	34	35	1,111	....	1916
20. Mandan, N.Dak	1914–32	1921–32	47	00	1,750	....	1914
21. Moccasin, Mont	1909–32	1921–32	47	15	4,228	....	1910
22. Moro, Oreg	1911–31	1920–31	45	40	1,800	....	1911
23. Nephi, Utah	1908–19	....	39	45	6,000	[1] 1908	....
24. North Platte, Nebr	1907–32	1921–32	41	20	2,841	1908	1915
25. Sheridan, Wyo	1917–32	1921–32	44	40	3,790	....	1917
26. Tucumcari, N.Mex	1913–32	1921–32	35	30	4,194	....	1913
27. Williston, N.Dak	1909–18	1917	48	00	1,875	1910	....
28. Woodward, Okla	1914–32	1921–32	36	30	1,900	....	1914

[1] Pan 4 feet in diameter.

TABLE 2

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Aberdeen, Idaho									
1920	° *F.*	*M.p.h.*		*Inches*	1920	° *F.*	*M.p.h.*		*Inches*
April	40.0	8.83	......	3.42	August	66.4	4.22	......	7.82
May	50.9	6.37	......	5.85	September	57.0	4.97	......	5.13
June	59.5	4.95	......	7.11					
July	69.3	4.23	......	8.64	Year	57.2	5.59	......	37.97
Akron, Colo.									
1921					1925				
April	45	10.0	[1] 0.217	5.505	April	50	8.6	0.289	5.828
May	57	8.3	.293	6.245	May	59	8.2	......	7.318
June	68	6.0	.438	7.773	June	69	7.0	......	8.857
July	74	6.8	.472	10.708	July	74	5.7	......	10.268
August	72	5.9	.446	8.594	August	71	5.5	......	8.717
September	64	7.0	.369	7.078	September	64	5.1	......	6.302
Year	63.3	7.3	.372	45.903	Year	64.5	6.7	......	47.290
1922					1926				
April	44	8.7	.222	4.276	April	48	8.2	......	5.566
May	56	8.0	.330	6.792	May	60	7.5	......	6.735
June	69	5.7	.511	8.225	June	67	6.4	......	8.269
July	71	5.4	.520	9.200	July	71	5.1	......	8.456
August	75	5.2	.584	8.853	August	73	5.3	......	8.983
September	66	4.9	.303	7.233	September	60	5.6	......	6.357
Year	63.5	6.3	.412	44.579	Year	63.2	6.4	......	44.366
1923					1927				
April	46	7.6	.247	5.091	April	45	7.1	......	4.625
May	54	7.9	.302	5.479	May	59	7.1	......	8.192
June	66	7.7	.387	7.808	June	63	5.0	......	6.419
July	73	5.5	......	9.058	July	70	3.8	......	8.528
August	69	5.1	......	7.703	August	65	3.5	......	6.406
September	62	5.4	......	6.290	September	61	3.3	......	6.259
Year	61.7	6.5	......	41.429	Year	60.5	5.0	......	40.429
1924					1928				
April	46	8.5	......	[2] 5.027	April	44	7.7	......	5.231
May	51	7.8	......	7.649	May	58	6.4	......	6.892
June	67	7.7	......	8.642	June	59	6.2	......	6.857
July	73	6.4	......	10.541	July	71	4.1	......	8.011
August	75	5.9	......	10.154	August	70	5.0	......	8.845
September	58	6.7	......	5.999	September	61	5.2	......	7.325
Year	61.7	7.2	......	48.012	Year	60.5	5.8	......	43.161

[1] Average 1909–32 (10 years' data).

TABLE 2—Continued

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Akron, Colo.—Continued									
1929	° *F.*	*M.p.h.*		*Inches*	1931	° *F.*	*M.p.h.*		*Inches*
April	46	8.8	......	[2] 5.027	April	46	5.3	......	[2] 5.027
May	55	7.6	......	6.919	May	54	5.9	......	7.166
June	67	6.3	......	9.044	June	70	4.4	......	8.443
July	75	5.1	......	9.020	July	75	4.5	......	10.225
August	74	3.9	......	7.702	August	71	3.6	......	9.229
September	57	4.7	......	4.285	September	67	3.9	......	7.442
Year	62.3	6.1	......	41.997	Year	63.8	4.6	......	47.532
1930					1932				
April	54	6.8	......	[2] 5.027	April	48	8.8	......	5.749
May	52	7.6	......	5.407	May	59	7.0	......	7.814
June	67	5.3	......	8.232	June	66	5.8	......	7.999
July	73	5.0	......	8.919	July	76	5.8	......	11.255
August	71	3.4	......	6.799	August	73	5.5	......	10.233
September	62	3.8	......	5.991	September	63	5.0	......	6.627
Year	63.2	5.3	......	40.375	Year	64.2	6.3	......	49.177
Archer, Wyo.									
1921					1927				
April	40	13.6	0.135	4.908	April	41	9.9	.150	5.156
May	51	7.4	.235	4.789	May	52	10.9	.188	7.232
June	64	5.7	.348	6.235	June	60	6.6	.315	5.337
July	69	4.6	.362	7.426	July	67	6.1	.359	5.902
August	68	5.3	.320	6.863	August	63	4.1	.361	4.543
September	60	6.8	.204	7.057	September	57	4.8	.246	4.387
Year	58.7	7.2	.270	37.278	Year	56.7	7.1	.270	32.557
1922					1928				
April	39	9.8	.162	3.288	April	37	9.4	.123	4.740
May	50	12.2	.212	6.855	May	53	7.3	.258	5.373
June	62	5.8	.329	7.371	June	54	5.9	.290	4.360
July	66	5.1	.337	7.117	July	67	5.1	.351	7.000
August	69	5.0	.387	6.717	August	65	5.5	.270	7.495
September	60	5.2	.223	6.622	September	57	6.7	.200	6.545
Year	57.7	7.2	.275	37.968	Year	55.6	6.6	.249	35.513
1923					1929				
April	40	11.6	.142	5.145	April	40	10.2	.150	5.303
May	51	11.2	.236	5.545	May	49	8.2	.244	5.345
June	59	6.1	.307	6.749	June	60	6.8	.297	7.015
July	68	4.8	.438	6.507	July	69	5.3	.385	7.804
August	64	4.6	.392	5.857	August	69	5.0	.370	6.736
September	56	5.2	.248	4.642	September	53	5.6	.266	4.207
Year	56.3	7.2	.294	34.445	Year	56.7	6.8	.285	36.410
1924					1930				
April	40	14.8	.148	6.049	April	50	7.6	.212	4.756
May	47	8.1	.190	5.648	May	47	7.6	.228	4.327
June	61	7.0	.299	7.170	June	62	6.2	.285	7.186
July	67	5.4	.321	8.201	July	70	5.0	.344	7.788
August	67	5.1	.264	8.303	August	66	4.9	.425	5.907
September	55	5.3	.233	5.284	September	57	4.9	.252	4.552
Year	56.2	7.6	.242	40.655	Year	58.7	6.0	.291	34.516
1925					1931				
April	45	9.1	.161	5.798	April	41	8.2	.136	4.794
May	53	7.8	.227	5.926	May	50	8.3	.187	5.863
June	62	7.7	.294	7.469	June	67	5.2	.312	6.313
July	69	6.3	.343	9.190	July	71	5.7	.312	9.133
August	64	5.1	.348	6.071	August	67	4.5	.316	7.203
September	59	6.0	.260	6.128	September	62	6.1	.241	6.371
Year	58.7	7.0	.272	40.582	Year	59.7	6.3	.251	39.677
1926					1932				
April	43	7.8	.164	4.572	April	43	11.2	.141	5.771
May	53	7.7	.232	5.645	May	53	6.9	.226	5.502
June	61	5.8	.318	6.123	June	61	5.3	.300	6.330
July	65	4.7	.381	5.612	July	71	5.4	.325	8.640
August	67	4.8	.315	6.303	August	68	5.0	.321	7.782
September	54	5.7	.224	5.377	September	59	4.8	.197	6.551
Year	57.2	6.1	.272	33.632	Year	59.2	6.4	.252	40.576
Ardmore, S.Dak.									
1921					1922				
April	44	6.9	0.181	5.121	April	42	6.8	.256	3.488
May	54	6.1	.288	4.735	May	55	7.5	.372	4.994
June	69	3.9	.426	6.058	June	68	4.5	.473	5.931
July	73	3.8	.415	8.524	July	68	4.2	.512	6.495
August	71	3.7	.350	8.333	August	74	4.2	.532	7.125
September	60	6.3	.216	8.097	September	64	4.1	.320	6.174
Year	61.8	5.1	.313	40.868	Year	61.8	5.2	.411	34.207

[2] Average, 1908–32 (20 years' data).

TABLE 2—Continued

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Ardmore, S.Dak.—Continued									
1923	° F.	M.p.h.		Inches	1928	° F.	M.p.h.		Inches
April	41	5.8	.193	4.373	April	43	6.5	.143	4.958
May	54	4.9	.301	4.325	May	59	3.9	.268	5.767
June	65	3.5	.446	5.107	June	59	4.7	.329	5.696
July	74	2.8	.569	6.398	July	71	3.4	.449	7.796
August	67	2.3	.495	5.660	August	70	3.9	.343	7.662
September	60	2.9	.384	4.990	September	59	3.5	.228	5.859
Year	60.2	3.7	.398	30.853	Year	60.2	4.3	.293	37.738
1924					1929				
April	43	6.8	.257	4.002	April	45	7.3	.170	4.178
May	49	5.4	.301	4.921	May	54	6.8	.236	5.816
June	64	6.0	.379	6.337	June	65	6.1	.335	7.126
July	71	4.8	.381	8.194	July	75	5.9	.413	10.050
August	71	4.5	.331	7.221	August	75	5.1	.372	9.302
September	59	5.0	.297	4.932	September	55	5.9	.277	4.166
Year	59.5	5.4	.324	35.607	Year	61.5	6.2	.300	40.638
1925					1930				
April	50	6.4	.248	4.306	April	53	5.6	.237	5.002
May	57	5.1	.312	4.899	May	53	7.2	.264	5.561
June	65	4.5	.409	6.342	June	65	5.7	.328	8.037
July	72	4.1	.489	8.003	July	78	5.5	.357	10.802
August	72	4.0	.408	7.156	August	73	5.3	.493	7.760
September	63	3.5	.343	5.447	September	61	5.0	.323	5.975
Year	63.2	4.6	.368	36.153	Year	63.8	5.7	.334	43.137
1926					1931				
April	47	5.5	.221	4.800	April	46	7.2	.179	4.941
May	58	4.0	.355	4.851	May	55	8.0	.243	7.075
June	66	4.7	.414	6.516	June	73	7.4	.368	10.811
July	72	4.2	.480	6.991	July	77	8.4	.346	11.088
August	71	3.8	.472	6.957	August	72	7.1	.382	9.954
September	57	5.6	.263	4.590	September	67	6.6	.284	7.891
Year	61.8	4.6	.368	34.705	Year	65.0	7.4	.300	51.760
1927					1932				
April	42	5.9	.206	3.540	April	49	10.3	.204	5.474
May	53	7.7	.279	5.890	May	58	7.4	.319	5.876
June	62	3.6	.404	5.191	June	67	6.0	.373	8.399
July	68	3.5	.480	6.358	July	76	6.1	.432	10.062
August	66	3.5	.414	5.658	August	73	5.4	.414	9.112
September	59	4.1	.310	4.771	September	61	4.8	.284	6.933
Year	58.3	4.7	.349	31.408	Year	64.0	6.7	.338	45.856
Biggs, Calif.									
1920					1923				
April	58.7	4.2	......	4.363	April	57.1	4.2	......	4.425
May	66.0	3.2	......	[3] 4.414	May	65.5	3.6	......	6.707
June	72.7	4.3	......	7.160	June	68.2	3.7	......	7.227
July	75.7	3.2	......	7.104	July	77.2	2.7	......	8.866
August	77.7	1.7	......	6.227	August	76.0	2.2	......	7.275
September	69.6	2.0	......	4.691	September	73.3	1.9	......	5.672
October	58.5	2.0	......	2.793	October	61.7	2.4	......	3.870
Year:					Year:				
Apr.-Sept	70.1	3.1	......	33.959	Apr.-Sept	69.6	3.0	......	40.172
Apr.-Oct	68.4	2.9	......	36.752	Apr.-Oct	68.4	3.0	......	44.042
1921					1924				
April	57.2	3.9	......	5.243	April	60.0	4.1	......	5.205
May	62.5	3.6	......	5.853	May	69.5	3.8	......	7.431
June	74.6	3.4	......	7.052	June	73.6	4.3	......	[3] 8.250
July	80.4	3.0	......	9.076	July	76.5	3.1	......	8.406
August	75.6	2.4	......	7.845	August	75.0	2.4	......	6.435
September	70.6	2.4	......	4.956	September	70.8	2.4	......	[3] 4.752
October	63.9	1.6	......	2.879	October	58.8	2.7	......	[4] 3.411
Year:					Year:				
Apr.-Sept	70.2	3.1	......	40.025	Apr.-Sept	70.9	3.4	......	40.479
Apr.-Oct	69.3	2.9	......	42.904	Apr.-Oct	69.2	3.3	......	43.890
1922					1925				
April	55.9	4.9	......	4.947	April	58.3	2.7	......	[3] 3.897
May	66.3	3.8	......	5.945	May	66.3	2.9	......	5.255
June	73.8	3.1	......	6.843	June	75.0	2.8	......	7.228
July	79.8	1.8	......	6.932	July	80.0	2.5	......	8.082
August	74.2	1.8	......	6.495	August	74.6	2.8	......	7.313
September	74.0	.9	......	4.324	September	67.4	2.2	......	4.677
October	60.9	1.6	......	2.542	October	61.5	1.6	......	3.270
Year:					Year:				
Apr.-Sept	70.7	2.7	......	35.486	Apr.-Sept	70.3	2.6	......	36.452
Apr.-Oct	69.3	2.6	......	38.028	Apr.-Oct	69.0	2.5	......	39.722

TABLE 2—Continued

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Biggs, Calif.—Continued									
1926	° F.	M.p.h.		Inches	1929	° F.	M.p.h.		Inches
April	62.1	3.3	......	[3] 4.137	September	69.2	1.4	......	5.289
May	66.4	3.5	......	[3] 6.098	October	63.6	2.0	......	4.030
June	76.9	2.6	......	6.921					
July	78.6	2.0	......	6.113	Year:				
August	74.9	1.8	......	5.792	Apr.-Sept	69.2	2.9	......	38.744
September	67.4	3.1	......	5.230	Apr.-Oct	68.4	2.8	......	42.774
October	62.6	2.6	......	3.397					
Year:					1930				
Apr.-Sept	71.0	2.7	......	34.291	April	59.4	3.3	......	4.273
Apr.-Oct	69.8	2.7	......	37.688	May	62.2	4.4	......	6.239
					June	74.2	2.9	......	6.721
1927					July	76.2	2.1	......	7.466
					August	74.1	1.9	......	5.558
April	58.2	3.7	......	[3] 4.050	September	67.1	1.9	......	4.726
May	64.7	4.0	......	5.971	October	60.7	1.8	......	3.446
June	73.2	3.9	......	[3] 7.170					
July	78.5	2.9	......	7.997	Year:				
August	74.2	2.8	......	6.782	Apr.-Sept	68.9	2.8	......	34.983
September	68.4	3.4	......	5.602	Apr.-Oct	67.7	2.6	......	38.429
October	62.9	2.7	......	3.878					
					1931				
Year:									
Apr.-Sept	69.5	3.4	......	37.572	April	61.0	3.7	......	5.395
Apr.-Oct	68.6	3.3	......	41.450	May	71.0	4.3	......	7.033
					June	71.7	4.2	......	7.326
1928					July	81.4	2.9	......	8.540
					August	76.9	2.2	......	7.484
April	56.7	2.9	......	3.623	September	67.9	3.2	......	5.921
May	69.6	3.7	......	6.751	October	60.6	2.5	......	3.297
June	74.0	4.2	......	8.105					
July	76.7	2.9	......	6.700	Year:				
August	75.6	1.5	......	5.686	Apr.-Sept	71.6	3.4	......	41.699
September	70.3	1.7	......	4.335	Apr.-Oct	70.1	3.3	......	44.996
October	61.0	1.9	......	3.313	1932				
					April	56.2	4.0	......	4.512
Year:					May	65.4	4.3	......	[3] 6.064
Apr.-Sept	70.5	2.8	......	35.200	June	73.7	2.9	......	5.488
Apr.-Oct	69.1	2.7	......	38.513	July	75.8	2.4	......	[3] 6.498
					August	74.5	2.0	......	[3] 5.251
1929					September	72.3	0.9	......	[3] 4.890
April	54.3	3.9	......	3.939	October	59.5	2.7	......	4.215
May	66.5	3.7	......	7.021					
June	72.3	3.4	......	6.455	Year:				
July	76.3	2.9	......	8.717	Apr.-Sept	69.6	2.8	......	32.703
August	76.6	2.1	......	7.323	Apr.-Oct	68.2	2.7	......	36.918
Big Springs, Tex.									
1921					1925				
April	61	7.4	0.226	9.213	April	68	6.5	.422	8.232
May	73	5.8	.406	9.110	May	71	5.6	.487	8.167
June	78	4.8	.551	9.129	June	81	5.9	.636	11.237
July	83	4.6	.523	11.507	July	83	5.0	.597	11.872
August	84	4.4	.499	12.839	August	79	3.7	.634	8.100
September	80	4.9	.542	8.815	September	75	4.1	.607	6.420
Year	76.5	5.3	.458	60.613	Year	76.2	5.1	.564	54.028
1922					1926				
April	62	7.0	.299	8.481	April	59	5.8	.313	5.398
May	71	4.8	.442	8.460	May	71	4.5	.416	8.292
June	76	4.2	.572	8.794	June	79	4.4	.568	10.148
July	82	5.2	.555	12.930	July	80	3.6	.625	9.981
August	82	3.3	.525	11.671	August	81	3.5	.595	10.107
September	76	3.5	.436	9.692	September	74	4.1	.570	7.665
Year	74.8	4.7	.472	60.028	Year	74.0	4.3	.514	51.591
1923					1927				
April	62	7.0	.336	5.950	April	67	5.3	.295	8.584
May	71	5.4	.373	8.852	May	78	5.7	.390	11.712
June	79	6.4	.557	9.790	June	80	5.3	.517	10.369
July	82	4.0	.542	10.374	July	82	3.9	.576	10.153
August	81	4.6	.527	10.326	August	84	4.6	.527	12.115
September	76	4.2	.530	6.927	September	75	4.2	.555	7.058
Year	75.2	5.3	.478	52.219	Year	77.7	4.8	.477	59.991
1924					1928				
April	62	5.9	.351	7.178	April	61	6.3	.239	8.365
May	68	5.0	.418	8.183	May	71	3.5	.462	7.437
June	86	6.1	.586	11.562	June	80	5.9	.518	10.962
July	84	5.4	.624	10.870	July	82	4.5	.596	9.708
August	85	5.3	.661	11.089	August	79	3.0	.635	7.170
September	71	3.8	.514	7.427	September	74	3.3	.466	6.944
Year	76.0	5.2	.526	56.309	Year	74.5	4.4	.486	50.586

[3] Certain days missing; prorated to a full month.
[4] Average, 1920-32, inclusive; 12 years' data.

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
Big Springs, Tex.—Continued									
1929	° F.	M.p.h.		Inches	1931	° F.	M.p.h.		Inches
April	66	5.9	.312	7.334	April	59	5.3	.293	5.609
May	69	5.1	.425	7.220	May	68	4.8	.393	7.554
June	82	5.2	.515	10.693	June	81	5.4	.540	9.470
July	81	3.7	.604	9.277	July	82	4.1	.556	9.549
August	83	2.8	.546	10.098	August	81	4.2	.501	9.551
September	74	3.3	.547	6.861	September	82	5.3	.505	9.210
Year	75.8	4.3	.492	51.483	Year	75.5	4.8	.465	50.943
1930					1932				
April	69	4.9	.321	6.061	April	65	5.9	.304	7.496
May	71	4.8	.409	8.119	May	69	5.1	.472	6.511
June	78	4.7	.585	8.712	June	77	4.0	.612	7.896
July	84	4.4	.557	11.651	July	82	4.2	.612	9.734
August	82	3.1	.555	10.225	August	79	3.7	.619	8.034
September	78	3.7	.475	9.181	September	69	2.4	.575	3.946
Year	77.0	4.3	.484	53.949	Year	73.5	4.2	.532	43.617
Chillicothe, Tex.									
1920					1926				
April	58	11.7	------	10.171	April	56.50	8.36	------	4.971
May	70	8.0	------	8.254	May	71.48	7.54	------	7.131
June	78	7.9	------	9.513	June	79.02	6.19	------	8.247
July	83	5.5	------	5.936	July	81.45	3.91	------	6.766
August	76	4.4	------	6.642	August	80.60	3.56	------	6.159
September	73	4.9	------	4.853	September	74.43	5.12	------	4.558
Year	73.0	7.1	------	45.369	Year	73.91	5.78	------	37.832
1921					1927				
April	61.1	10.30	------	7.774	April	67.23	8.20	------	6.655
May	72.7	9.04	------	8.205	May	76.95	9.15	------	8.883
June	77.4	6.36	------	9.352	June	78.82	7.18	------	7.628
July	83.6	6.05	------	9.204	July	81.92	4.95	------	7.620
August	84.8	5.16	------	10.141	August	81.47	4.47	------	7.002
September	79.8	6.09	------	8.496	September	75.60	5.10	------	5.077
Year	76.6	7.17	------	53.172	Year	77.00	6.51	------	42.865
1922					1928				
April	60	8.03	------	5.887	April	61.1	9.74	------	7.208
May	71	7.58	------	7.207	May	72.1	6.84	------	8.023
June	80	6.09	------	8.441	June	79.5	9.60	------	8.213
July	83	6.09	------	10.162	July	83.7	5.80	------	7.542
August	85	5.08	------	10.487	August	82.2	4.44	------	6.544
September	76	4.73	------	8.087	September	75.3	4.98	------	5.933
Year	75.8	6.27	------	50.091	Year	75.6	6.90	------	43.463
1923					1929				
April	61.6	8.53	------	6.078	April	68.1	8.82	------	7.433
May	69.9	9.21	------	10.259	May	69.1	8.50	------	5.341
June	78.0	7.37	------	8.887	June	81.8	7.22	------	7.965
July	85.2	4.39	------	9.735	July	83.6	4.87	------	8.067
August	83.3	4.29	------	10.881	August	85.3	3.71	------	8.834
September	75.6	4.12	------	5.801	September	74.6	4.37	------	5.283
Year	75.6	6.32	------	51.641	Year	77.1	6.25	------	42.923
1924					1930				
April	61.1	8.95	------	6.420	April	70.3	7.74	------	7.333
May	67.6	7.61	------	8.019	May	70.8	8.36	------	7.183
June	83.9	7.97	------	10.649	June	81.4	7.42	------	8.656
July	81.1	5.65	------	8.647	July	86.5	5.50	------	10.856
August	84.4	5.49	------	8.398	August	85.5	4.92	------	10.264
September	69.8	5.39	------	6.657	September	80.2	5.46	------	7.707
Year	74.6	6.84	------	48.790	Year	79.1	6.57	------	51.999
1925					1931				
April	68.13	8.86	------	8.132	April	57.8	8.0	------	4.377
May	70.32	7.86	------	8.183	May	67.5	6.8	------	6.332
June	83.11	7.65	------	10.340	June	82.6	7.1	------	9.297
July	85.19	5.53	------	9.374	July	85.2	4.8	------	8.252
August	79.03	4.00	------	6.087	August	82.7	4.5	------	7.399
September	74.36	4.15	------	4.384	September	83.5	5.3	------	8.771
Year	76.69	6.34	------	46.500	Year	76.6	6.1	------	44.428
Colby, Kans.									
1921					1922				
April	49	9.2	0.202	5.277	April	48	9.0	.228	3.535
May	61	9.6	.355	7.030	May	59	7.0	.315	6.499
June	69	5.2	.507	6.033	June	72	6.9	.455	8.359
July	76	5.7	.544	8.720	July	75	6.0	.465	9.057
August	74	4.2	.563	6.409	August	77	5.3	.483	8.295
September	67	4.9	.428	5.894	September	69	6.2	.310	6.840
Year	66.0	6.5	.433	39.363	Year	66.7	6.7	.376	42.585

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
Colby, Kans.—Continued									
1923	° F.	M.p.h.		Inches	1928	° F.	M.p.h.		Inches
April	49	[5] 8.4	.205	5.431	April	47	8.7	.184	6.118
May	56	8.2	.342	5.250	May	61	6.6	.343	5.948
June	68	7.5	.545	6.609	June	62	6.4	.439	5.228
July	74	4.5	.556	7.341	July	74	5.4	.567	7.364
August	71	4.0	.523	6.887	August	73	6.7	.452	8.770
September	64	5.3	.351	5.844	September	64	5.7	.290	7.153
Year	63.7	6.3	.420	37.371	Year	63.5	6.6	.379	40.581
1924					1929				
April	50	8.1	.188	5.610	April	51	9.1	.206	5.804
May	54	7.0	.208	6.712	May	58	8.6	.337	5.102
June	70	7.3	.461	7.871	June	69	6.1	.429	7.049
July	74	8.0	.440	10.194	July	79	6.8	.484	9.982
August	75	7.2	.480	8.037	August	77	5.3	.496	8.217
September	61	7.6	.336	6.282	September	61	7.4	.397	5.782
Year	64.0	7.5	.352	45.306	Year	65.8	7.2	.392	41.936
1925					1930				
April	54	8.8	.230	6.142	April	54	7.8	.308	4.820
May	60	7.5	.328	6.697	May	57	8.5	.345	5.546
June	75	9.1	.400	10.395	June	69	5.7	.463	7.633
July	77	6.3	.423	10.892	July	78	5.5	.448	9.502
August	74	7.0	.485	8.471	August	76	4.9	.532	7.540
September	67	7.1	.403	6.371	September	66	4.4	.375	5.036
Year	67.8	7.6	.378	48.968	Year	66.7	6.1	.412	40.077
1926					1931				
April	47	7.5	.180	5.341	April	48	7.2	.225	3.993
May	63	8.9	.318	7.312	May	56	7.4	.298	6.066
June	70	7.0	.377	8.520	June	74	7.1	.483	8.897
July	77	8.0	.445	11.476	July	76	6.6	.460	9.804
August	77	7.1	.431	10.353	August	73	5.6	.446	8.006
September	64	9.1	.390	6.285	September	72	7.2	.341	8.156
Year	66.3	7.9	.357	49.287	Year	66.5	6.8	.376	44.922
1927					1932				
April	53	8.8	.250	5.017	April	52	10.2	.208	5.730
May	63	10.8	.267	8.940	May	63	9.2	.316	7.589
June	67	7.7	.423	7.063	June	68	5.6	.466	6.869
July	75	6.1	.464	9.037	July	80	7.5	.498	10.344
August	69	5.2	.502	6.014	August	76	7.6	.508	9.147
September	66	7.4	.381	7.154	September	64	6.3	.351	6.289
Year	65.5	7.7	.381	43.225	Year	67.2	7.7	.391	45.968
Crowley, La.; lat. 30°15′; elevation 21 feet									
1920					1923				
April	68	5.2	------	3.174	April	69	4.0	------	3.284
May	77	2.6	------	5.052	May	74	3.3	------	5.502
June	79	2.1	------	4.946	June	81	2.3	------	5.290
July	81	1.7	------	4.388	July	81	2.1	------	4.897
August	81	1.2	------	5.522	August	82	1.9	------	5.345
September	80	[6] 1.9	------	5.253	September	78	1.3	------	4.369
October	66	[6] 2.6	------	3.097	October	67	3.0	------	4.328
Year:					Year:				
Apr.-Sept.	77.7	2.4	------	28.335	Apr.-Sept.	77.5	2.5	------	28.687
Apr.-Oct.	76.0	2.5	------	31.432	Apr.-Oct.	76.0	2.6	------	33.015
1921					1924				
April	67	[6] 5.4	------	4.939	April	69	3.9	------	4.299
May	73	2.3	------	6.766	May	73	2.7	------	5.023
June	80	2.1	------	5.714	June	83	2.2	------	[7] 6.018
July	82	[6] 1.6	------	4.946	July	82	2.3	------	[7] 5.552
August	85	1.3	------	6.501	August	85	1.7	------	5.869
September	81	0.9	------	4.110	September	78	2.8	------	6.961
October	68	[6] 3.1	------	3.371	October	69	2.5	------	5.860
Year:					Year:				
Apr.-Sept.	78.0	2.3	------	32.976	Apr.-Sept.	78.3	2.6	------	33.722
Apr.-Oct.	76.6	2.4	------	36,347	Apr.-Oct.	77.0	2.6	------	39.582
1922					1925				
April	71	4.9	------	4.838	April	77	3.2	------	4.961
May	76	3.1	------	5.911	May	81	2.5	------	5.839
June	81	1.7	------	5.305	June	83	2.8	------	6.260
July	82	[6] 1.9	------	5.610	July	84	2.2	------	5.568
August	82	1.7	------	5.832	August	84	2.1	------	6.713
September	78	1.6	------	4.652	September	82	1.6	------	4.011
October	68	[6] 2.2	------	4.649	October	70	2.8	------	4.572
Year:					Year:				
Apr.-Sept.	78.3	2.5	------	32.148	Apr.-Sept.	81.8	2.4	------	33.352
Apr.-Oct.	76.9	2.4	------	36.797	Apr.-Oct.	80.1	2.5	------	37.924

[5] Average, 1915–32, inclusive (17 years' record).
[6] Certain days missing; prorated to a full month.
[7] Average, 1910–31, inclusive.

TABLE 2—Continued

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Crowley, La.; lat. 30°15′; elevation 21 feet—Continued									
1926	° F.	M.p.h.		Inches	1929	° F.	M.p.h.		Inches
April	66	3.2	------	3.981	April	72	6.5	------	5.036
May	73	2.5	------	4.357	May	75	4.9	------	5.612
June	81	1.9	------	6.373	June	81	2.2	------	5.894
July	82	1.6	------	5.531	July	81	2.2	------	5.530
August	82	1.9	------	4.958	August	82	2.1	------	6.297
September	82	1.8	------	5.238	September	78	2.4	------	5.443
October	74	2.0	------	3.643	October	70	3.0	------	4.725
Year:					Year:				
Apr.-Sept	77.7	2.2	------	30.438	Apr.-Sept	78.2	3.4	------	33.812
Apr.-Oct	77.1	2.1	------	34.081	Apr.-Oct	77.0	3.3	------	38.537
1927					1930				
April	72	3.7	------	4.238	April	70	4.0	------	4.487
May	78	3.8	------	4.791	May	76	4.9	------	5.298
June	84	1.6	------	5.291	June	80	2.7	------	7.375
July	82	.7	------	3.937	July	83	2.3	------	5.662
August	81	.9	------	4.961	August	82	2.3	------	6.285
September	79	1.0	------	4.676	September	78	2.4	------	4.212
October	72	1.5	------	4.042	October	68	2.8	------	3.738
Year:					Year:				
Apr.-Sept	79.3	2.0	------	27.894	Apr.-Sept	78.2	3.1	------	33.319
Apr.-Oct	78.3	2.0	------	31.936	Apr.-Oct	76.7	3.1	------	37.057
1928					1931				
April	64	5.8	------	4.852	April	65	3.8	------	3.322
May	73	3.3	------	6.131	May	72	3.6	------	6.774
June	80	3.7	------	5.827	June	81	2.6	------	5.882
July	82	1.4	------	5.056	July	83	2.9	------	6.550
August	83	1.6	------	5.378	August	80	1.8	------	5.044
September	75	2.3	------	4.683	September	80	1.7	------	5.760
October	73	2.1	------	4.482	October	73	2.3	------	4.546
Year:					Year:				
Apr.-Sept	76.2	3.0	------	31.927	Apr.-Sept	76.8	2.7	------	33.332
Apr.-Oct	75.7	2.9	------	36.409	Apr.-Oct	76.3	2.7	------	37.878
Dalhart, Tex.; lat. 36°20′; elevation 4,000 feet									
1921					1926				
April	52	8.9	0.168	6.826	April	48	7.2	.255	4.618
May	64	8.3	.339	7.425	May	62	6.4	.373	6.314
June	69	6.3	.468	6.912	June	70	4.7	.454	6.960
July	74	4.7	.533	7.655	July	75	4.4	.459	8.503
August	75	4.2	.479	7.351	August	76	3.9	.435	9.269
September	71	6.5	.371	8.304	September	68	6.2	.479	6.953
Year	67.5	6.5	.393	44.473	Year	66.5	5.5	.409	42.617
1922					1927				
April	53	8.0	.221	6.397	April	57	7.7	.286	7.266
May	62	6.7	.299	7.955	May	68	7.1	.326	10.727
June	73	5.3	.448	9.091	June	71	6.7	.499	9.529
July	78	5.8	.441	9.582	July	76	4.8	.595	9.081
August	80	4.8	.426	9.914	August	72	3.9	.559	6.636
September	72	5.6	.357	6.807	September	66	5.1	.463	5.174
Year	69.7	6.0	.365	49.746	Year	68.3	5.9	.455	48.413
1923					1928				
April	54	8.2	.254	6.161	April	51	8.9	.212	6.610
May	62	8.2	.331	7.472	May	63	6.6	.356	7.236
June	71	6.6	.460	7.430	June	69	6.3	.452	7.546
July	77	4.3	.485	8.140	July	77	4.6	.504	7.545
August	75	4.2	.501	8.337	August	73	4.5	.520	7.213
September	66	4.3	.398	5.817	September	67	4.8	.348	7.430
Year	67.5	6.0	.405	43.357	Year	66.7	6.0	.399	43.580
1924					1929				
April	53	7.8	.199	7.307	April	55	8.9	.210	7.301
May	58	6.0	.284	7.465	May	60	8.8	.316	6.427
June	74	5.9	.378	9.407	June	72	5.8	.417	8.285
July	75	5.9	.466	9.089	July	76	5.5	.539	9.836
August	76	4.6	.495	9.077	August	75	3.8	.516	8.180
September	65	4.5	.360	6.387	September	65	6.0	.396	6.291
Year	66.8	5.8	.364	48.732	Year	67.2	6.5	.399	46.320
1925					1930				
April	57	7.4	.199	7.389	April	59	6.4	.259	7.524
May	65	6.3	.349	7.041	May	62	7.9	.284	9.273
June	76	6.1	.419	9.721	June	73	6.8	.424	9.967
July	78	4.8	.532	9.043	July	77	5.7	.462	11.162
August	72	3.4	.570	6.602	August	76	4.7	.485	9.358
September	68	4.4	.533	5.573	September	69	5.1	.337	8.067
Year	69.3	5.4	.434	45.369	Year	69.3	6.1	.375	55.351

TABLE 2—Continued

Month and year	Θ_e	W	V	E_e	Month and year	Θ_e	W	V	E_e
Dalhart, Tex.; lat. 36°20′; elevation 4,000 feet—Continued									
1931	° F.	M.p.h.		Inches	1932	° F.	M.p.h.		Inches
April	51	8.2	0.231	5.193	April	55	8.5	0.193	7.320
May	60	7.2	.291	7.355	May	65	6.5	.290	8.340
June	75	5.4	.404	10.620	June	70	5.1	.451	7.925
July	77	5.1	.463	10.528	July	78	4.6	.462	10.414
August	73	3.8	.473	7.731	August	76	4.2	.465	9.855
September	73	5.0	.385	8.153	September	66	4.9	.354	6.747
Year	68.2	5.8	.374	49.580	Year	68.3	5.6	.369	50.601
Dickinson, N.Dak.									
Dickinson, N.Dak.; lat. 47°00′; elevation 2,543 feet									
1921					1927				
April	39	7.5	0.154	4.028	April	41	8.2	0.215	3.490
May	52	7.4	.270	4.524	May	48	9.5	.274	3.832
June	69	6.0	.489	7.336	June	61	4.5	.435	4.755
July	71	5.6	.427	8.687	July	65	5.5	.477	6.845
August	67	5.5	.393	7.358	August	63	3.8	.448	5.095
September	54	7.4	.274	4.171	September	56	5.5	.364	4.300
Year	58.7	6.6	.334	36.104	Year	55.7	6.2	.369	28.317
1922					1928				
April	42	6.5	.197	3.107	April	37	5.7	.184	3.523
May	54	8.9	.311	5.377	May	58	4.8	.247	6.582
June	63	4.5	.428	5.466	June	58	4.2	.339	4.210
July	65	3.0	.462	5.314	July	67	3.7	.515	5.785
August	69	4.8	.426	7.453	August	64	4.1	.413	6.403
September	58	4.7	.308	5.273	September	53	3.7	.259	4.160
Year	58.5	5.4	.355	31.990	Year	56.2	4.4	.326	30.063
1923					1929				
April	39	5.7	.196	2.954	April	40	6.3	.175	3.635
May	53	5.9	.284	5.024	May	48	6.6	.214	5.580
June	64	5.8	.439	6.631	June	59	5.9	.363	5.666
July	70	4.1	.586	6.327	July	70	4.9	.474	8.096
August	63	3.4	.418	4.800	August	68	4.9	.391	8.167
September	59	4.7	.351	4.336	September	51	5.2	.261	4.195
Year	58.0	4.9	.379	30.072	Year	56.0	5.6	.313	35.939
1924					1930				
April	39	6.8	.202	2.732	April	48	6.3	.219	4.083
May	45	5.9	.242	4.335	May	49	8.2	.241	5.257
June	56	4.7	.396	4.506	June	61	6.4	.370	6.070
July	65	4.5	.463	6.959	July	72	4.8	.383	10.967
August	61	4.7	.387	6.370	August	69	6.2	.390	7.688
September	56	5.2	.287	4.675	September	55	6.0	.273	4.898
Year	53.7	5.3	.330	29.577	Year	59.0	6.3	.313	38.963
1925					1931				
April	47	7.3	.281	4.174	April	44	6.5	.156	4.914
May	54	6.8	.371	6.311	May	53	7.8	.207	7.616
June	61	6.1	.445	6.179	June	68	6.3	.406	7.849
July	67	4.7	.481	7.825	July	69	5.9	.405	8.701
August	68	4.7	.455	7.620	August	66	5.5	.422	6.183
September	56	5.5	.388	4.330	September	59	5.6	.327	6.238
Year	58.8	5.8	.404	36.439	Year	59.8	6.3	.320	41.501
1926					1932				
April	43	7.2	.204	4.836	April	45	7.9	.230	3.181
May	58	8.3	.327	6.076	May	55	6.3	.301	5.078
June	61	6.0	.366	6.530	June	65	5.1	.477	5.862
July	70	5.6	.438	8.720	July	70	5.2	.457	8.873
August	64	5.4	.407	6.285	August	67	5.7	.427	7.168
September	51	6.0	.289	3.726	September	54	5.2	.272	5.867
Year	57.8	6.4	.338	36.173	Year	59.3	5.9	.361	36.029
Garden City, Kans.									
1921					1922				
April	52	10.2	0.255	7.004	April	52	11.3	0.252	5.202
May	64	9.8	.481	9.462	May	62	8.7	.350	7.502
June	72	4.7	.602	8.695	June	75	8.7	.483	10.755
July	78	5.0	.666	9.442	July	79	8.5	.488	11.896
August	78	4.5	.593	9.125	August	80	6.3	.509	11.983
September	72	5.8	.435	9.623	September	73	8.3	.385	10.135
Year	69.3	6.7	.505	53.351	Year	70.2	8.6	.411	57.473

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
Garden City, Kans.—Continued									
1923	° F.	M.p.h.		Inches	1928	° F.	M.p.h.		Inches
April	54	10.6	0.239	6.810	April	50	12.1	0.203	7.426
May	60	10.6	.381	6.736	May	62	8.5	.393	7.911
June	71	10.5	.554	8.027	June	66	8.9	.516	7.272
July	78	7.3	.584	10.466	July	77	7.0	.596	9.992
August	76	5.8	.542	9.090	August	75	6.7	.527	10.053
September	67	6.6	.439	6.775	September	68	6.1	.328	8.316
Year	67.7	8.6	.456	47.904	Year	66.3	8.2	.427	50.970
1924					1929				
April	52	10.1	.225	5.725	April	55	10.5	.249	6.866
May	57	8.2	.256	7.142	May	60	10.1	.385	6.340
June	72	9.0	.481	10.458	June	73	8.3	.448	10.128
July	76	9.1	.531	10.993	July	80	7.5	.536	12.054
August	78	8.2	.530	10.843	August	78	6.1	.572	10.191
September	65	8.0	.380	8.165	September	65	9.0	.396	8.312
Year	66.7	8.8	.400	53.326	Year	68.5	8.6	.431	53.891
1925					1930				
April	57	10.4	.282	7.369	April	58	9.0	.349	7.055
May	64	9.0	.366	8.244	May	61	10.1	.339	8.710
June	78	10.2	.469	12.412	June	74	9.2	.446	11.284
July	80	7.3	.506	12.316	July	81	8.7	.453	13.913
August	77	7.9	.491	10.900	August	79	7.2	.485	11.683
September	70	8.3	.439	7.513	September	70	6.4	.420	8.917
Year	71.0	8.8	.426	58.754	Year	70.5	8.4	.415	61.562
1926					1931				
April	48	8.6	.233	5.828	April	51	9.9	.262	4.932
May	64	9.3	.391	8.254	May	59	9.0	.325	7.548
June	73	8.5	.496	10.252	June	79	9.8	.457	12.527
July	78	7.8	.535	12.168	July	79	7.8	.474	12.417
August	78	6.5	.595	11.165	August	76	7.0	.484	10.345
September	68	9.5	.504	8.245	September	77	9.4	.380	10.946
Year	68.2	8.4	.459	55.912	Year	70.2	8.8	.397	58.715
1927					1932				
April	56	10.1	.288	6.137	April	56	11.4	.236	7.026
May	66	11.4	.345	11.232	May	66	9.0	.335	9.181
June	71	10.7	.463	10.304	June	71	7.7	.510	8.119
July	78	8.5	.507	12.160	July	83	9.8	.535	13.450
August	72	6.6	.572	7.856	August	78	9.8	.526	11.462
September	70	8.6	.440	8.909	September	68	7.9	.384	7.363
Year	68.8	9.3	.436	56.598	Year	70.3	9.3	.421	56.601
Havre, Mont.									
1921					1925				
April	42	7.6	0.167	4.054	April	47	6.7	0.223	3.300
May	53	6.9	.257	5.294	May	56	6.4	.231	6.622
June	66	5.0	.353	7.024	June	63	4.1	.388	4.961
July	69	5.5	.364	8.734	July	68	4.5	.358	7.078
August	68	4.7	.303	8.306	August	65	3.9	.309	5.446
September	52	6.8	222	4.890	September	54	4.2	.284	3.222
Year	58.3	6.1	.278	38.302	Year	58.8	5.0	.299	30.629
1922					1926				
April	42	6.3	.186	2.783	April	46	6.7	.161	5.155
May	53	7.4	.249	5.325	May	57	6.8	.234	6.904
June	65	5.5	.341	6.936	June	63	5.8	.291	7.035
July	67	4.3	.352	6.965	July	72	4.3	.360	8.652
August	70	5.5	.360	7.229	August	65	5.4	.357	6.117
September	60	5.9	.250	5.152	September	46	4.6	.256	2.215
Year	59.5	5.8	.290	34.390	Year	58.2	5.6	.276	36.078
1923					1927				
April	42	7.0	.139	4.628	April	41	8.0	.167	4.483
May	54	6.7	.224	6.648	May	47	7.3	.246	3.860
June	63	6.0	.370	6.333	June	60	4.5	.374	5.489
July	69	4.0	.528	5.827	July	67	3.5	.435	6.188
August	64	3.6	.378	4.945	August	65	3.8	.375	4.632
September	57	3.8	.274	4.124	September	54	4.9	.280	3.138
Year	58.2	5.2	.319	32.505	Year	55.7	5.3	.313	27.790
1924					1928				
April	42	7.8	.174	4.028	April	40	7.4	.156	3.507
May	53	5.8	.271	5.867	May	60	5.9	.237	6.737
June	58	5.2	.338	5.272	June	58	5.6	.320	4.504
July	68	4.5	.385	7.159	July	69	4.8	.437	7.229
August	65	4.8	.338	6.394	August	62	4.2	.342	5.727
September	57	4.9	.253	4.377	September	54	4.9	.247	4.352
Year	57.2	5.5	.293	33.097	Year	57.2	5.5	.290	32.056

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
Havre, Mont.—Continued									
1929	° F.	M.p.h.		Inches	1931	° F.	M.p.h.		Inches
April	39	7.1	0.167	3.933	April	45	7.7	0.156	5.655
May	51	6.1	.233	5.310	May	55	6.5	.201	7.553
June	61	5.4	.320	6.039	June	66	6.4	.308	9.147
July	71	4.2	.281	8.685	July	68	5.3	.334	8.612
August	70	3.8	.287	7.111	August	67	4.2	.337	7.490
September	51	3.7	.227	3.615	September	58	5.2	.261	5.464
Year	57.2	5.0	.252	34.693	Year	59.6	5.9	.266	43.921
1930					1932				
April	51	7.2	.223	4.797	April	46	8.4	.189	4.272
May	53	7.2	.241	6.280	May	56	7.7	.269	6.533
June	62	7.0	.276	7.942	June	62	4.9	.401	6.144
July	72	5.4	.328	9.671	July	69	5.4	.359	8.531
August	71	5.3	.344	8.491	August	67	5.8	.348	7.346
September	56	5.2	.283	4.092	September	57	6.0	.237	4.983
Year	60.8	6.2	.282	41.273	Year	59.5	6.4	.300	37.809
Hays, Kans.									
1921					1927				
April	54	10.6	0.263	6.174	April	55	8.0	0.315	4.559
May	65	8.3	.432	7.252	May	64	11.0	.370	7.809
June	73	5.3	.619	6.043	June	70	8.6	.490	7.660
July	79	6.1	.665	8.671	July	77	6.2	.533	9.261
August	77	5.4	.585	8.188	August	71	5.4	.566	6.270
September	73	8.2	.546	8.229	September	69	6.7	.444	6.963
Year	70.2	7.3	.518	44.557	Year	67.7	7.6	.453	42.522
1922					1928				
April	53	10.1	.326	4.388	April	49	10.0	.192	6.407
May	63	7.9	.470	5.912	May	63	7.6	.414	6.454
June	74	6.7	.584	7.931	June	65	7.3	.489	4.965
July	77	7.1	.628	8.258	July	77	6.6	.654	8.002
August	81	6.2	.592	10.531	August	76	6.4	.589	8.159
September	74	8.8	.464	10.300	September	67	7.3	.332	8.321
Year	70.3	7.8	.511	47.320	Year	66.2	7.5	.445	42.308
1923					1929				
April	53	11.3	.267	5.997	April	55	10.2	.279	5.584
May	60	8.6	.421	5.578	May	60	8.8	.374	5.320
June	72	7.4	.616	6.583	June	72	7.6	.508	7.968
July	80	7.1	.646	9.823	July	79	7.0	.600	9.340
August	77	6.2	.566	8.584	August	79	6.3	.548	8.482
September	69	7.2	.466	6.238	September	65	8.6	.400	7.043
Year	68.5	8.0	.497	42.803	Year	68.3	8.1	.452	43.737
1924					1930				
April	53	9.7	.267	5.483	April	57	------	------	[8] 5,662
May	57	7.8	.307	6.782	May	61	------	------	[8] 6.683
June	73	7.0	.551	7.738	June	71	------	------	[8] 8.047
July	76	7.6	.572	10.835	July	81	------	------	[8] 9,800
August	80	7.5	.596	10.325	August	80	6.7	.574	9.801
September	65	7.8	.406	7.459	September	69	5.9	.466	6.379
Year	67.3	7.9	.450	48.622	Year	69.8	[9] 7.9	[10] .453	46.372
1925					1931				
April	58	9.5	.330	6.002	April	51	8.4	.277	4.718
May	62	7.8	.377	6.784	May	59	8.7	.364	6.575
June	78	10.6	.532	11.633	June	78	7.9	.556	9.517
July	79	6.2	.579	9.487	July	80	6.8	.538	10.267
August	76	5.6	.611	7.925	August	76	6.6	.523	9.560
September	71	7.2	.556	6.978	September	79	9.6	.418	11.634
Year	70.7	7.8	.498	48.809	Year	70.5	8.0	.446	52.271
1926					1932				
April	48	8.2	.263	5.501	April	55	10.8	.280	5.811
May	65	8.8	.449	7.357	May	64	7.7	.415	7.119
June	73	7.7	.471	9.382	June	72	5.3	.619	6.693
July	80	8.2	.559	11.408	July	83	7.5	.626	11.029
August	80	6.9	.511	11.159	August	78	7.3	.599	9.511
September	68	10.2	.472	7.227	September	67	6.3	.433	6.151
Year	69.0	8.3	.454	52.034	Year	69.8	7.5	.495	46.314
Hettinger, N.Dak.									
1921					1921				
April	42	7.0	0.183	3.710	August	71	5.1	0.417	7.316
May	53	6.7	.282	4.216	September	56	6.6	[11] .327	4.168
June	71	5.3	.488	5.985					
July	73	5.5	.417	8.857	Year	61.0	6.0	.352	34.252

[8] Average, 1907–32, inclusive.
[9] Average, 1908–32 (24 years' data).
[10] Average, 1907–32 (25 years' data).
[11] Average, 1911–20 (6 years' data).

TABLE 2—Continued

Month and year	Θ_a	W	V	E_o	Month and year	Θ_a	W	V	E_o
Lawton, Okla.									
1921	° F.	M.p.h.		Inches	1927	° F.	M.p.h.		Inch
April	59	8.1	0.328	5.205	April	64	6.7	[12].344	5.061
May	71	6.1	.506	6.412	May	73	7.1	[13].501	7.882
June	77	4.5	.710	5.139	June	76	4.8	.620	7.572
July	81	4.3	.736	7.045	July	80	3.7	.648	7.886
August	83	4.4	.660	8.101	August	79	4.2	.657	7.643
September	80	5.8	.657	6.851	September	74	5.4	.551	6.185
Year	75.2	5.5	.600	38.753	Year	74.3	5.3	.554	42.229
1922					1928				
April	61	7.8	.402	4.418	April	58	9.0	------	5.111
May	69	5.5	.545	4.615	May	70	5.9	------	6.151
June	78	3.9	.616	6.533	June	75	6.6	------	6.324
July	82	4.8	.620	8.580	July	81	4.1	------	7.604
August	84	4.1	.581	8.791	August	81	3.6	------	7.973
September	76	3.6	[14].598	6.626	September	73	4.0	------	7.521
Year	75.0	5.0	.560	39.563	Year	73.0	5.5	[14].554	40.684
1923					1929				
April	61	7.6	[12].344	4.670	April	65	8.0	------	5.414
May	68	6.9	[13].501	6.492	May	66	7.4	------	5.834
June	77	5.2	[14].650	7.096	June	78	6.1	------	8.476
July	84	3.3	.634	8.665	July	81	4.1	------	8.549
August	83	4.6	.582	9.952	August	84	3.9	------	10.269
September	74	4.0	.603	5.358	September	72	3.4	------	5.001
Year	74.5	5.3	.552	42.233	Year	74.3	5.5	[14].554	43.543
1924					1930				
April	59	6.2	[12].344	5.190	April	67	7.4	------	6.254
May	64	5.2	[13].501	6.099	May	68	6.4	------	5.508
June	82	6.3	.666	9.067	June	78	6.2	------	7.747
July	80	4.6	.618	8.056	July	83	4.3	------	10.466
August	84	5.3	.662	8.716	August	84	3.4	------	10.097
September	70	4.4	.455	6.392	September	78	4.7	------	8.052
Year	73.2	5.3	.541	43.520	Year	76.3	5.4	[14].554	48.124
1925					1931				
April	67	7.5	[12].344	6.979	April	56	7.1	.435	4.013
May	68	5.1	[13].501	6.014	May	65	7.2	.556	6.129
June	83	5.9	[14].650	10.364	June	81	6.4	.786	9.222
July	85	5.5	[15].669	11.564	July	83	5.0	.848	9.437
August	80	3.3	.628	7.619	August	80	4.6	.764	7.618
September	76	3.8	.607	6.152	September	81	5.7	.764	9.213
Year	76.5	5.2	.566	48.692	Year	74.3	6.0	.692	45.632
1926					1932				
April	56	6.8	[12].344	4.671	April	63	8.4	[12].344	5.989
May	69	5.3	.494	6.353	May	70	6.1	.491	7.178
June	78	5.1	.581	9.011	June	78	5.2	.701	6.977
July	80	4.2	.635	8.739	July	83	4.4	.718	9.196
August	81	3.9	.663	8.242	August	81	5.3	.692	8.476
September	74	4.4	.607	5.625	September	73	4.0	.600	5.297
Year	73.0	5.0	.554	42.641	Year	74.6	5.6	.591	43.113
Mandan, N.Dak.									
1921					1924				
April	43	6.3	0.170	3.638	April	41	8.3	0.173	3.410
May	55	6.3	.291	5.147	May	49	7.7	.180	4.900
June	71	5.6	.494	7.324	June	59	5.2	.372	4.467
July	74	4.7	.452	8.899	July	67	4.8	.423	6.822
August	71	5.4	.398	8.524	August	65	5.1	.380	6.054
September	59	7.1	.279	5.730	September	57	5.6	.283	4.146
Year	62.2	5.9	.347	39.262	Year	56.3	6.1	.302	29.799
1922					1925				
April	45	6.4	.214	3.379	April	50	7.9	.210	4.297
May	58	7.2	.323	5.337	May	55	6.7	.239	5.834
June	66	4.3	.456	5.638	June	62	6.7	.402	5.527
July	68	3.8	.477	6.740	July	68	4.8	.426	6.462
August	73	4.7	.472	7.935	August	69	5.1	.391	6.239
September	61	4.5	.335	4.826	September	59	5.2	.345	3.695
Year	61.8	5.2	.380	33.855	Year	60.5	6.1	.336	32.054
1923					1926				
April	41	5.7	.182	3.166	April	45	7.6	.139	4.852
May	57	6.9	.280	5.696	May	59	6.7	.275	5.631
June	67	6.8	.433	7.340	June	63	7.1	.308	6.697
July	73	5.1	.569	7.245	July	72	5.7	.391	8.148
August	65	4.4	.396	5.584	August	67	5.3	.404	5.438
September	60	6.2	.320	4.505	September	53	6.3	.293	3.701
Year	60.5	5.8	.363	33.536	Year	59.8	6.4	.302	34.467

[12] Average, 1917–32, inclusive (7-years' data).
[13] Average, 1917–32, inclusive (9 years).

TABLE 2—Continued

Month and year	Θ_a	W	V	E_o	Month and year	Θ_a	W	V	E_o
Mandan, N.Dak.—Continued									
1927	° F.	M.p.h.		Inches	1930	° F.	M.p.h.		Inches
April	43	8.4	0.195	3.601	April	49	6.7	0.210	3.690
May	49	9.2	.262	3.981	May	51	8.2	.238	5.290
June	62	4.9	.416	4.687	June	64	6.6	.369	6.143
July	66	4.3	.456	6.578	July	75	4.4	.422	8.324
August	66	4.2	.433	5.407	August	70	4.4	.428	6.314
September	57	5.6	.338	4.824	September	57	5.2	.288	4.652
Year	57.2	6.1	.350	29.078	Year	61.0	5.9	.326	34.413
1928					1931				
April	36	7.5	.138	3.790	April	45	7.0	.151	4.016
May	60	6.1	.253	6.790	May	54	7.6	.207	5.794
June	59	5.2	.363	5.216	June	69	5.9	.436	6.436
July	68	3.7	.535	6.004	July	71	5.4	.443	7.467
August	66	4.3	.455	5.972	August	67	5.3	.433	5.592
September	55	5.1	.261	4.437	September	63	5.3	.328	5.153
Year	57.3	5.3	.334	32.209	Year	61.5	6.1	.333	34.458
1929					1932				
April	43	6.4	.174	3.295	April	46	7.7	.217	2.737
May	51	7.1	.227	5.440	May	56	6.3	.287	4.584
June	62	5.6	.346	6.162	June	67	5.4	.478	6.087
July	73	4.5	.395	8.211	July	71	5.0	.451	7.216
August	71	4.5	.353	6.712	August	69	5.1	.394	6.372
September	52	5.0	.265	3.630	September	58	5.1	.231	5.338
Year	58.7	5.5	.293	33.450	Year	61.2	5.8	.343	32.334
Moccasin, Mont.									
1921					1926				
April	39	10.2	0.129	4.057	April	43	6.8	0.169	4.606
May	49	8.3	.223	4.139	May	52	6.9	.230	5.089
June	61	5.4	.346	5.340	June	59	6.8	.280	6.364
July	64	5.0	.341	6.789	July	66	5.1	.358	7.316
August	66	5.3	.261	7.579	August	62	6.4	.324	6.309
September	49	7.2	.190	4.171	September	45	5.8	.233	3.442
Year	54.7	6.9	.248	32.075	Year	54.5	6.3	.266	33.126
1922					1927				
April	38	8.3	.161	3.157	April	38	7.9	.157	3.799
May	49	9.8	.199	5.490	May	43	7.5	.197	4.300
June	61	5.5	.355	5.884	June	57	5.7	.318	4.330
July	63	4.4	.336	6.676	July	63	4.9	.408	7.112
August	68	4.9	.354	7.797	August	61	4.6	.346	5.558
September	60	5.6	.265	5.746	September	52	5.7	.278	4.097
Year	56.5	6.4	.278	34.750	Year	52.3	6.0	.284	29.196
1923					1928				
April	40	7.1	.141	3.772	April	37	8.2	.158	4.580
May	51	6.7	.221	5.436	May	55	7.0	.218	6.876
June	58	5.5	.324	5.451	June	54	6.3	.270	7.598
July	66	4.0	.452	6.356	July	63	4.9	.402	7.132
August	61	3.5	.360	5.582	August	61	4.6	.276	6.045
September	56	4.1	.248	4.936	September	54	5.8	.241	5.155
Year	55.3	5.2	.291	31.533	Year	54.0	6.1	.261	37.386
1924					1929				
April	38	7.9	.164	4.157	April	38	7.0	.145	3.649
May	49	6.7	.205	4.903	May	49	7.5	.204	5.288
June	53	5.7	.301	4.109	June	56	6.1	.204	5.774
July	63	4.7	.315	6.691	July	68	5.7	.277	9.096
August	61	4.9	.266	6.813	August	69	5.7	.294	7.853
September	54	6.3	.221	5.016	September	48	5.5	.246	3.977
Year	53.0	6.0	.245	31.689	Year	54.7	6.2	.243	35.637
1925					1930				
April	44	8.7	.189	3.605	April	48	5.6	.270	3.110
May	51	7.8	.211	5.939	May	49	6.8	.250	4.936
June	57	5.9	.323	4.895	June	59	6.9	.273	7.325
July	66	5.5	.336	8.168	July	69	5.3	.323	8.282
August	64	6.6	.270	7.566	August	67	5.2	.353	6.820
September	52	6.2	.255	4.329	September	56	5.6	.280	4.329
Year	55.7	6.8	.264	34.502	Year	58.0	5.9	.292	34.802

[14] Average, 1917–32 (11 years).
[15] Average, 1917–32 (12 years).

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
Moccasin, Mont.—Continued									
1931	° F.	M.p.h.		Inches	1932	° F.	M.p.h.		Inches
April	42	8.3	0.142	4.279	April	43	8.2	0.160	4.210
May	52	7.4	.196	5.481	May	53	6.7	.243	5.275
June	62	6.3	.307	6.941	June	58	5.0	.330	5.188
July	67	5.8	.312	8.741	July	66	5.2	.330	7.690
August	66	5.4	.319	7,672	August	65	5.7	.318	7.723
September	56	5.8	.252	5.046	September	56	6.5	.225	5.416
Year	57.5	6.5	.255	38.160	Year	56.8	6.2	.268	35.502
Moro, Oreg.									
1920					1926				
April	44.8	8.1	------	4.39	April	53.8	5.3	------	4.86
May	51.7	9.0	------	7.67	May	54.3	6.0	------	5.79
June	59.9	8.2	------	7.46	June	67.0	9.0	------	10.29
July	69.4	8.9	------	10.62	July	71.0	11.3	------	13.12
August	68.3	6.6	------	7.67	August	67.5	8.1	------	8.83
September	57.9	6.0	------	4.39	September	55.3	6.4	------	5.56
October	46.8	5.5	------	2.70	October	50.7	4.7	------	2.45
Year:					Year:				
Apr.-Sept	58.7	7.8	------	42.20	Apr.-Sept	61.5	7.7	------	48.45
Apr.-Oct	57.0	7.5	------	44.90	Apr.-Oct	59.9	7.3	------	50.90
1921					1927				
April	45.4	7.2	------	4.20	April	46.5	8.0	------	5.23
May	55.0	5.8	------	5.70	May	51.7	8.8	------	5.71
June	63.5	4.3	------	7.58	June	62.0	6.4	------	7.10
July	65.9	8.0	------	10.42	July	68.8	5.9	------	10.00
August	67.5	7.9	------	9.05	August	67.9	5.6	------	8.89
September	55.5	6.4	------	5.23	September	57.1	6.4	------	3.51
October	51.1	3.8	------	2.88	October	50.4	4.4	------	2.19
Year:					Year:				
Apr.-Sept	58.8	6.6	------	42.18	Apr.-Sept	59.0	6.8	------	40.44
Apr.-Oct	57.7	6.2	------	45.06	Apr.-Oct	57.8	6.5	------	42.63
1922					1928				
April	44.4	9.5	------	3.79	April	45.0	7.5	------	3.91
May	52.9	8.6	------	7.09	May	58.9	7.5	------	7.33
June	65.7	9.5	------	10.50	June	60.7	11.6	------	8.82
July	67.9	9.6	------	11.69	July	70.2	9.6	------	11.34
August	65.4	8.3	------	7.96	August	67.4	9.5	------	8.88
September	62.1	6.4	------	6.10	September	58.8	7.0	------	5.13
October	51.7	4.8	------	2.36	October	50.1	5.8	------	3.13
Year:					Year:				
Apr.-Sept	59.7	8.6	------	47.13	Apr.-Sept	60.2	8.8	------	45.41
Apr.-Oct	58.6	8.1	------	49.49	Apr.-Oct	58.7	8.4	------	48.54
1923					1929				
April	47.9	7.6	------	4.53	April	46.2	9.6	------	4.18
May	53.5	8.3	------	6.07	May	55.8	9.6	------	6.96
June	59.3	6.4	------	6.53	June	61.6	7.7	------	7.00
July	69.2	6.3	------	9.37	July	70.0	9.3	------	10.00
August	69.7	6.8	------	10.27	August	71.1	9.9	------	9.45
September	61.5	5.6	------	5.73	September	58.5	6.3	------	5.86
October	48.8	4.8	------	2.43	October	52.5	5.7	------	3.40
Year:					Year:				
Apr.-Sept	60.2	6.8	------	42.50	Apr.-Sept	60.5	8.7	------	43.45
Apr.-Oct	58.6	6.5	------	44.93	Apr.-Oct	59.4	8.3	------	46.85
1924					1930				
April	48.8	9.0	------	5.56	April	51.8	7.5	------	4.26
May	60.4	9.1	------	8.49	May	53.3	12.0	------	7.24
June	63.5	7.9	------	9.91	June	59.3	11.2	------	7.92
July	65.6	11.0	------	11.59	July	69.9	11.4	------	10.91
August	66.2	7.2	------	10.52	August	71.3	9.7	------	8.55
September	59.8	6.0	------	6.27	September	61.2	7.6	------	4.82
October	49.4	5.3	------	2.83	October	46.7	5.6	------	2.00
Year:					Year:				
Apr.-Sept	60.7	8.4	------	52.34	Apr.-Sept	61.1	9.9	------	43.70
Apr.-Oct	59.1	7.9	------	55.17	Apr.-Oct	59.1	9.3	------	45.70
1925					1931				
April	50.4	8.0	------	4.99	April	48.8	7.9	------	4.26
May	57.2	6.5	------	6.01	May	59.6	9.0	------	7.33
June	62.5	5.9	------	7.73	June	61.8	6.9	------	6.67
July	72.1	7.1	------	10.15	July	69.8	9.5	------	10.31
August	65.3	7.0	------	7.69	August	68.7	9.5	------	10.11
September	60.1	5.4	------	5.80	September	59.4	8.2	------	5.22
October	50.9	4.0	------	4.08	October	50.2	5.9	------	2.65
Year:					Year:				
Apr.-Sept	61.3	6.6	------	42.37	Apr.-Sept	61.3	8.5	------	43.90
Apr.-Oct	59.8	6.3	------	46.45	Apr.-Oct	59.8	8.1	------	46.55

TABLE 2—Continued

Month and year	Θ_a	W	V	E_a	Month and year	Θ_a	W	V	E_a
North Platte, Nebr.									
1921	° F.	M.p.h.		Inches	1927	° F.	M.p.h.		Inches
April	49	10.1	0.216	4.570	April	50	8.4	0.243	4.196
May	60	10.2	.341	6.637	May	60	10.8	.320	7.218
June	71	6.7	.504	7.185	June	65	7.3	.418	6.194
July	77	7.2	.549	10.873	July	72	5.7	.473	7.971
August	73	3.3	.514	8.015	August	68	4.9	.499	5.349
September	65	4.3	.365	5.502	September	64	6.0	.388	5.548
Year	65.8	7.0	.415	42.782	Year	63.2	7.2	.390	36.476
1922					1928				
April	48	8.6	.246	4.644	April	45	10.3	.168	6.139
May	60	8.1	.332	6.684	May	61	7.2	.331	6.301
June	72	6.8	.475	8.243	June	61	5.9	.401	4.802
July	72	5.5	.563	7.033	July	73	5.1	.597	6.730
August	77	5.2	.548	8.057	August	72	5.6	.512	7.561
September	68	5.7	.364	6.312	September	61	5.2	.306	6.148
Year	66.2	6.6	.421	40.973	Year	62.2	6.6	.386	37.681
1923					1929				
April	47	6.6	.198	4.669	April	50	8.5	.214	4.592
May	56	8.2	.311	5.731	May	56	8.9	.315	5.575
June	67	8.5	.505	6.491	June	67	6.1	.460	6.626
July	74	4.9	.614	6.863	July	77	7.0	.586	8.679
August	69	4.3	.535	5.489	August	77	5.5	.512	8.326
September	63	5.4	.378	4.966	September	58	6.0	.346	4.384
Year	62.6	6.3	.424	34.209	Year	64.2	7.0	.406	38.182
1924					1930				
April	49	9.1	.180	5.672	April	54	8.3	.247	4.382
May	52	8.5	.222	5.949	May	56	9.0	.310	5.685
June	66	6.7	.479	6.281	June	67	6.3	.454	6.179
July	72	6.9	.484	8.119	July	77	5.0	.510	8.331
August	73	6.2	.503	7.935	August	74	4.6	.552	5.980
September	59	7.0	.341	4.749	September	65	4.8	.375	4.807
Year	61.8	7.4	.368	38.705	Year	65.5	6.3	.408	35.364
1925					1931				
April	53	9.0	.221	5.347	April	49	6.9	.200	4.277
May	58	8.2	.306	6.256	May	57	8.3	.269	6.795
June	71	7.6	.474	7.662	June	73	6.6	.501	8.198
July	75	5.5	.503	9.503	July	77	6.2	.486	10.268
August	73	7.2	.520	7.579	August	72	6.0	.509	8.710
September	66	5.9	.397	5.165	September	70	6.4	.399	7.649
Year	66.0	7.2	.404	41.512	Year	66.3	6.7	.394	45.897
1926					1932				
April	47	6.3	.172	5.312	April	52	10.7	.237	5.449
May	64	7.8	.321	7.459	May	63	9.4	.324	7.705
June	67	7.0	.422	7.453	June	69	6.8	.475	6.989
July	75	6.5	.532	8.797	July	77	7.5	.556	9.112
August	75	6.7	.528	8.593	August	75	7.0	.557	8.207
September	60	7.2	.426	4.615	September	63	5.9	.365	6.267
Year	64.6	6.9	.400	42.229	Year	66.5	7.9	.417	43.729
Sheridan, Wyo.									
1921					1924				
April	43	7.4	0.169	4.599	April	41	4.6	0.175	2.373
May	54	6.4	.294	4.715	May	50	4.4	.229	3.158
June	68	5.2	.408	7.045	June	59	3.4	.341	5.129
July	73	4.7	.337	9.647	July	67	3.1	.358	6.943
August	70	4.3	.306	7.922	August	66	2.7	.280	7.193
September	54	6.7	.196	5.310	September	57	3.1	.249	4.628
Year	60.3	5.8	.285	39.238	Year	56.7	3.6	.272	29.424
1922					1925				
April	40	6.0	.184	2.659	April	48	5.5	.214	6.709
May	53	6.6	.257	4.275	May	55	5.0	.283	5.399
June	65	2.7	.416	6.031	June	62	3.7	.370	5.599
July	67	2.1	.415	5.980	July	70	2.9	.386	7.754
August	72	2.2	.408	6.610	August	69	3.6	.322	7.910
September	61	2.3	.247	5.531	September	58	3.5	.298	4.469
Year	59.7	3.6	.321	31.086	Year	60.3	4.0	.312	37.840
1923					1926				
April	41	4.7	.157	2.766	April	46	4.6	.185	3.951
May	55	5.2	.258	4.655	May	56	3.9	.284	4.606
June	62	4.1	.360	5.327	June	63	4.0	.316	6.295
July	74	3.7	.452	7.846	July	71	3.9	.357	7.752
August	66	3.0	.375	5.635	August	69	3.9	.322	7.050
September	58	3.8	.304	5.352	September	51	3.6	.240	3.755
Year	59.3	4.1	.318	31.581	Year	59.3	4.0	.284	33.499

TABLE 2—Continued

Month and year	Θ_a	W	V	E_o	Month and year	Θ_a	W	V	E_o
Sheridan, Wyo.—Continued									
1927	° F.	M.p.h.		Inches	1930	° F.	M.p.h.		Inches
April	41	4.4	0.164	2.900	April	52	4.5	0.239	3.781
May	50	5.9	.240	4.600	May	53	6.1	.253	4.659
June	61	4.0	.367	4.944	June	62	4.7	.315	7.075
July	67	2.8	.416	6.164	July	74	3.6	.393	8.659
August	63	2.4	.383	4.577	August	72	4.0	.394	7.446
September	56	3.3	.283	3.902	September	59	3.5	.248	5.225
Year	56.3	3.8	.309	27.087	Year	62.0	4.4	.307	36.845
1928					1931				
April	42	5.7	.151	3.386	April	45	5.1	.158	4.029
May	58	4.4	.259	5.593	May	54	5.2	.227	5.420
June	57	3.7	.311	4.718	June	69	3.8	.377	7.592
July	68	2.8	.457	5.905	July	74	4.4	.336	9.850
August	65	3.1	.320	6.257	August	72	4.0	.320	8.043
September	56	3.7	.223	5.007	September	62	4.1	.244	5.916
Year	57.7	3.9	.287	30.866	Year	62.7	4.4	.277	40.850
1929					1932				
April	41	5.1	.163	2.863	April	47	6.7	.186	3.887
May	51	5.0	.222	4.603	May	56	4.7	.307	4.734
June	61	3.9	.331	5.866	June	63	2.8	.407	5.379
July	72	3.3	.376	7.520	July	72	3.5	.366	8.111
August	73	3.5	.352	7.767	August	71	3.6	.328	8.209
September	53	3.5	.242	3.929	September	58	3.3	.244	4.900
Year	58.5	4.0	.281	32.548	Year	61.2	4.1	.306	35.220
Tucumcari, N.Mex.									
1921					1926				
April	55	7.3	0.196	7.861	April	53	5.5	0.239	5.273
May	66	5.7	.352	7.826	May	63	5.3	.324	7.236
June	72	3.7	.504	6.416	June	73	4.5	.392	9.336
July	77	3.3	.533	8.377	July	76	3.9	.450	9.505
August	77	3.2	.501	8.993	August	77	3.8	.406	9.962
September	74	4.9	.414	8.629	September	71	5.9	.395	7.851
Year	70.0	4.7	.417	48.102	Year	68.8	4.8	.368	49.163
1922					1927				
April	56	6.8	.224	7.237	April	61	6.8	.148	9.453
May	65	5.8	.281	9.049	May	72	7.9	.181	14.445
June	76	5.6	.444	9.938	June	73	7.1	.342	11.125
July	81	5.5	.435	12.175	July	79	5.1	.466	10.374
August	82	4.5	.422	11.106	August	75	4.0	.486	8.061
September	74	4.3	.346	8.174	September	69	4.9	.420	6.340
Year	72.3	5.4	.359	57.679	Year	71.5	6.0	.340	59.798
1923					1928				
April	56	7.1	.233	7.065	April	55	6.6	.148	6.889
May	66	5.7	.274	9.995	May	65	4.6	.329	7.307
June	75	6.7	.418	10.344	June	74	5.8	.347	10.808
July	80	4.9	.470	11.310	July	80	4.9	.449	10.805
August	77	4.5	.477	9.772	August	75	4.9	.538	8.741
September	69	3.2	.394	6.530	September	70	4.5	.392	8.154
Year	70.5	5.4	.378	55.016	Year	69.8	5.2	.367	52.704
1924					1929				
April	56	6.8	.205	7.142	April	58	7.2	.240	8.525
May	62	5.8	.288	8.147	May	62	6.8	.330	7.646
June	78	5.5	.343	12.121	June	75	6.1	.378	10.441
July	77	4.9	.481	10.112	July	78	5.2	.463	10.860
August	78	4.8	.462	10.200	August	78	4.1	.456	9.014
September	68	4.8	.382	8.308	September	69	5.5	.386	6.919
Year	69.8	5.4	.360	56.030	Year	70.0	5.8	.376	53.405
1925					1930				
April	60	7.1	.181	9.388	April	64	5.6	.216	8.242
May	67	6.5	.324	9.260	May	64	7.9	.238	10.235
June	78	7.5	.361	12.329	June	76	7.0	.405	10.659
July	80	5.1	.471	11.090	July	78	5.2	.457	10.010
August	75	4.8	.473	8.736	August	79	4.2	.458	9.299
September	69	4.7	.454	6.038	September	72	4.4	.327	7.920
Year	71.5	6.0	.377	56.841	Year	72.2	5.7	.350	56.365

TABLE 2—Continued

Month and year	Θ_a	W	V	E_o	Month and year	Θ_a	W	V	E_o
Tucumcari, N.Mex.—Continued									
1931	° F.	M.p.h.		Inches	1932	° F.	M.p.h.		Inches
April	55	6.4	0.229	5.874	April	58	6.5	0.215	8.033
May	61	5.3	.293	7.891	May	66	6.1	.358	9.067
June	76	4.8	.425	10.273	June	73	5.0	.460	9.456
July	78	4.6	.567	9.957	July	80	4.9	.498	11.409
August	74	3.8	.543	8.097	August	78	5.1	.477	10.027
September	75	4.4	.489	7.756	September	68	4.2	.396	6.389
Year	69.8	4.9	.424	49.848	Year	70.5	5.3	.400	54.381
Williston, N.Dak.									
1917					1917				
April	37	5.7	0.192	2.008	August	67	5.4	0.444	6.746
May	53	5.5	.250	6.375	September	57	6.2	.301	3.710
June	62	7.1	.406	5.951					
July	73	5.8	.556	8.353	Year	58.2	6.0	.358	33.143
Woodward, Okla.									
1921					1927				
April	57	9.1	0.273	6.921	April	60	7.6	0.379	5.599
May	69	6.8	.429	8.044	May	70	8.3	.490	8.157
June	75	5.4	.614	7.280	June	75	7.2	.566	9.250
July	81	6.1	.654	9.323	July	80	6.0	.609	9.813
August	81	5.8	.583	10.294	August	75	4.5	.670	6.324
September	76	8.8	.555	8.751	September	72	6.8	.522	6.955
Year	73.2	7.0	.518	50.613	Year	72.0	6.7	.539	46.098
1922					1928				
April	57	8.1	.326	7.919	April	54	10.4	.238	7.319
May	68	6.9	.466	8.905	May	67	6.1	.438	6.990
June	78	5.7	.604	10.592	June	71	6.5	.579	7.060
July	82	6.0	.631	11.032	July	81	7.1	.642	9.844
August	83	6.3	.589	11.526	August	80	6.8	.603	10.016
September	75	6.4	.478	7.839	September	72	7.9	.427	9.242
Year	73.8	6.6	.516	57.813	Year	70.8	7.5	.488	50.480
1923					1929				
April	57	8.4	.331	5.504	April	61	10.6	.347	6.635
May	64	6.4	.422	6.343	May	64	7.5	.456	5.325
June	76	7.4	.601	8.421	June	77	7.9	.562	9.829
July	83	5.8	.642	10.698	July	81	7.0	.639	10.365
August	82	6.6	.540	11.642	August	83	6.3	.578	11.028
September	73	6.7	.555	6.503	September	70	7.3	.463	7.620
Year	72.5	6.9	.515	49.111	Year	72.6	7.8	.508	50.802
1924					1930				
April	57	9.1	.279	6.318	April	63	7.9	.322	7.053
May	61	6.0	.343	6.423	May	66	7.3	.434	7.312
June	80	7.6	.556	10.489	June	78	7.4	.567	9.960
July	81	6.5	.601	9.086	July	84	7.4	.584	12.962
August	82	6.5	.618	9.489	August	83	6.6	.545	11.711
September	68	6.2	.435	7.414	September	76	7.6	.445	8.842
Year	71.5	7.0	.472	49.219	Year	75.0	7.4	.483	57.840
1925					1931				
April	63	8.1	.339	6.854	April	54	7.9	.283	4.636
May	67	6.8	.430	7.167	May	63	7.0	.359	6.875
June	82	7.9	.720	11.781	June	80	6.8	.543	10.664
July	82	5.5	.669	9.871	July	83	6.1	.574	10.828
August	79	5.1	.668	8.714	August	78	5.9	.517	9.084
September	73	5.5	.609	6.566	September	80	9.4	.496	10.896
Year	74.3	6.5	.572	50.953	Year	73.0	7.2	.462	52.983
1926					1932				
April	52	6.8	.316	4.774	April	60	9.5	.312	6.631
May	68	7.0	.522	7.336	May	68	7.1	.421	8.316
June	77	7.2	.610	10.378	June	75	5.4	.623	7.616
July	79	5.4	.663	9.704	July	84	8.0	.647	12.232
August	80	5.4	.659	8.607	August	80	8.2	.632	10.709
September	71	8.1	.570	6.970	September	71	5.5	.458	6.626
Year	71.2	6.6	.557	47.769	Year	73.0	7.3	.516	52.130

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*

Aberdeen, Idaho; lat. 42°40′; elevation 4,400 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1	2	3	4	5	6
1912 [1]	6	62.2	0.262	7.6	[2] 37.211
1913	6	58.7	.255	5.8	39.632
1914	6	58.2	.227	5.4	38.515
1915	6	58.2	.212	5.6	41.234
1916	6	57.2	.182	5.8	44.429
1917	6	57.3	.209	5.4	40.825
1918	6	58.7	.218	5.2	40.906
1919	6	60.8	.189	5.1	41.894
1920	6	57.2		5.6	37.970
15-year average,[3] 1917–31		59.2		5.5	42.20

Akron, Colo.; lat. 40°40′; elevation 4,650 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1908	8	62.5	0.309	7.6	44.936
1909	8	60.0	.332	7.6	42.235
1910	8	62.3	.313	6.9	43.621
1911	8	63.0	.290	8.1	48.818
1912	8				
1913	8	62.5	.290	6.9	42.960
1914	8	62.8	.319	6.8	41.863
1915	8	58.8	.342	6.5	33.550
1916	6	61.3	.279	7.3	47.166
1917	6	60.3	.307	6.7	42.709
1918	6	61.2	.313	7.0	41.422
1919	6	63.2	.325	7.2	47.232
1920	6	58.2	.364	6.4	40.912
1921	6	63.3	[4] .372	7.3	45.903
1922	6	63.5	.412	6.3	44.579
1923	6	61.7		6.5	40.016
1924	6	61.7		7.2	[5] 48.012
1925	6	64.5		6.7	47.290
1926	6	63.2		6.4	44.366
1927	6	60.5		5.0	40.429
1928	6	60.5		5.8	43.161
1929	6	62.3		6.1	[5] 41.997
1930	6	63.2		5.3	[5] 40.375
1931	6	63.8		4.6	[5] 47.532
1932	6	64.2		6.3	49.177
15-year average, 1917–31		62.0		6.3	43.729
20-year average, 1913–32		62.0		6.4	43.533

Amarillo, Tex.; lat. 35°20′; elevation 3,676 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1908	8	68.0	0.348	5.8	50.406
1909	8	69.2	.352	7.7	56.230
1910	6	69.5	.359	8.5	58.602
1911	6	69.5	.403	8.2	53.077
1912	6	67.5	.338	8.4	52.861
1913	6	69.5	.372	7.8	53.794
1914	6	69.5	.433	8.7	49.273
1915	6	67.0	.409	7.1	42.930
1916	6	73.8	.348	8.6	56.429
1917	6	67.5	.350	8.6	54.741
1918	6	69.2	.332	9.2	56.584
1919	6	67.8	.422	6.8	40.790
15-year average,[6] 1917–31		69.5		7.3	47.89

Archer, Wyo.; lat. 41°00′; elevation 6,012 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1913 [1]	6	62.8	0.306	6.3	[7] 37.155
1914	6	59.2	.262	7.1	40.935
1915	6	55.5	.275	7.0	30.363
1916	6	57.2	.252	7.0	39.612
1917	6	55.8	.251	7.2	35.349
1918	6	56.2	.221	6.6	33.520
1919	6	59.7	.280	6.6	42.660
1920	6	54.0	.275	6.2	33.083
1921	6	58.7	.270	7.2	37.278
1922	6	57.7	.275	7.2	37.968
1923	6	56.3	.294	7.2	34.445
1924	6	56.2	.242	7.6	40.655
1925	6	58.7	.272	7.0	40.582
1926	6	57.2	.272	6.1	33.632
1927	6	56.7	.270	7.1	32.557
1928	6	55.6	.249	6.6	35.513
1929	6	56.7	.285	6.8	36.410
1930	6	58.7	.291	6.0	34.516
1931	6	59.7	.251	6.3	39.677
1932	6	59.2	.252	6.4	40.576
15-year average, 1917–31		57.2	.267	6.7	36.523
20-year average, 1913–32		57.5	.267	6.7	36.312

[1] Mean of 4 months, June, July, August, and September.
[2] 4 months, June–September.
[3] Computed by ratios of Akron, Moccasin, and Moro.
[4] Month of April=average 1908–32 (10 years, data).
[5] Month of April=average 1908–32 (20 years, data).
[6] Computed by ratios of Dalhart, Tucumcari, and Chillicothe.
[7] 4 months, June–September. Average for April and May 19 years' data. Prorated for 6 months.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Ardmore, S.Dak.; lat. 43°20′; elevation 3,557 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1	2	3	4	5	6
1913	6	63.2	0.324	5.9	44.135
1914	6	63.0	.311	6.7	41.777
1915	6	59.2	.334	5.3	28.908
1916	6	59.5	.351	5.7	38.870
1917	6	59.2	.296	4.9	39.261
1918	6	59.3	.317	4.9	34.533
1919	6	62.7	.323	4.7	40.624
1920	6	59.0	.316	5.0	33.082
1921	6	61.8	.313	5.1	40.868
1922	6	61.8	.411	5.2	34.207
1923	6	60.2	.398	3.7	30.853
1924	6	59.5	.324	5.4	35.607
1925	6	63.2	.368	4.6	36.153
1926	6	61.8	.368	4.6	34.705
1927	6	58.3	.349	4.7	31.408
1928	6	60.2	.293	4.3	37.738
1929	6	61.5	.300	6.2	40.638
1930	6	63.8	.334	5.7	43.137
1931	6	65.0	.300	7.4	51.760
1932	6	64.0	.338	6.7	45.856
15-year average, 1917–31		61.2	.334	5.1	37.638
20-year average, 1913–32		61.3	.333	5.3	38.206

Biggs, Calif.; lat. 39°0′; elevation 94 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1914	6	70.0	0.444	4.3	38.165
1915	6	70.7	.422	3.7	41.190
1916	6	70.3	.418	4.0	45.330
1917	6	71.3	.400	3.6	44.390
1918	6	70.5	.424	2.9	47.924
1919	6	71.3	.457	3.1	42.952
1920	6	70.1		3.1	[8] 33.959
1921	6	70.2		3.1	40.025
1922	6	70.7		2.7	35.486
1923	6	69.6		3.0	40.172
1924	6	70.9		3.4	[9] 40.479
1925	6	70.3		2.6	36.452
1926	6	71.0		2.7	[10] 34.291
1927	6	69.5		3.4	[11] 37.572
1928	6	70.5		2.8	35.200
1929	6	69.2		2.9	38.744
1930	6	68.9		2.8	34.983
1931	6	71.6		3.4	41.699
1932	6	69.6		2.8	[12] 32.703
15-year average, 1917–31		70.4		3.0	38.955

Big Springs, Tex.; lat. 32°0′; elevation 2,396 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1915 [1]	6	78.2	0.558	6.4	[2] 37.108
1916	6	75.2	.444	7.0	58.131
1917	6	75.8	.390	7.9	67.791
1918	6	76.2	.389	6.8	65.921
1919	6	73.2	.505	5.1	50.888
1920	6	72.5	.500	5.0	53.441
1921	6	76.5	.458	5.3	60.613
1922	6	74.8	.472	4.7	60.028
1923	6	75.2	.478	5.3	52.219
1924	6	76.0	.526	5.2	56.309
1925	6	76.2	.564	5.1	54.028
1926	6	74.0	.514	4.3	51.591
1927	6	77.7	.477	4.8	59.991
1928	6	74.5	.486	4.4	50.586
1929	6	75.8	.492	4.3	51.483
1930	6	77.0	.484	4.3	53.949
1931	6	75.5	.465	4.8	50.943
1932	6	73.5	.532	4.2	43.617
15-year average, 1917–31		75.4	.480	5.2	55.986

Burns, Oreg.; lat. 43°40′; elevation 4,125 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_a
1914	6	56.8	0.221	4.4	41.403
1915	6	55.8	.216	4.5	40.764
1916	6	53.3	.227	4.8	39.261
1917	6	52.8	.209	4.5	35.417
1918	6	56.0	.244	4.4	41.489
1919	6	57.5	.208	5.9	42.956
15-year average, 1917–31 [13]		55.6		4.4	39.52

[1] Mean of 4 months, June, July, August, and September.
[2] 4 months, June–September.
[8] Certain days missing in April. Prorated to a full month.
[9] Certain days missing in June and September. Prorated to a full month.
[10] Certain days missing in April and May. Prorated to a full month.
[11] Certain days missing in April and June. Prorated to a full month.
[12] May, July, August, and September. Prorated for 6 months.
[13] Computed by ratios of Biggs, Maro, and Moccasin.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Chillicothe, Tex.; lat. 34°20′; elevation 1,406 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1	2	3	4	5	6
1912 [1]	6	78.5	0.570	5.4	[2] 35.782
1913	6	76.2	.445	7.2	55.252
1914	6				
1915	6	73.5	.543	5.4	39.670
1916	6	75.2	.460	7.5	53.234
1917	6	74.5	.409	8.1	55.333
1918	6	76.3	.422	7.8	60.605
1919	6	73.5	.541	6.2	42.811
1920	6	73.0		7.1	45.369
1921	6	76.6		7.17	53.172
1922	6	75.8		6.27	50.001
1923	6	75.6		6.32	51.641
1924	6	74.6		6.84	48.790
1925	6	76.7		6.34	46.500
1926	6	73.9		5.78	37.832
1927	6	77.0		6.51	42.865
1928	6	75.6		6.90	43.463
1929	6	77.1		6.25	42.923
1930	6	79.1		6.57	51.999
1931	6	76.6		6.10	44.428
1932	6				
15-year average, 1917–31		75.7		6.7	47.855

Colby, Kans.; lat. 39°30′; elevation 3,135 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1914 [1]	6	72.8	0.471	6.0	[2] 33.419
1915	6	62.5	.427	6.1	31.657
1916	6	65.2	.349	7.6	45.532
1917	6	63.7	.346	7.3	38.720
1918	6	65.3	.346	7.8	41.375
1919	6	65.5	.411	6.3	39.641
1920 [14]	6	62.4	.410	6.2	[15] 33.127
1921	6	66.0	.433	6.5	39.363
1922	6	66.7	.376	6.7	42.585
1923	6	63.7	.420	[16] 6.3	37.371
1924	6	64.0	.352	7.5	45.306
1925	6	67.8	.378	7.6	48.968
1926	6	66.3	.357	7.9	49.287
1927	6	65.5	.381	7.7	43.225
1928	6	63.5	.379	6.6	40.581
1929	6	65.8	.392	7.2	41.936
1930	6	66.7	.412	6.1	40.077
1931	6	66.5	.376	6.8	44.922
1932	6	67.2	.391	7.7	45.968
15-year average, 1917–31		65.3	.385	7.0	41.766

Crowley, La.; lat. 30°15′; elevation 21 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1910	6	76.7	0.686	2.8	32.808
1911	6	78.3	.734	2.6	33.129
1912	6	77.5	.735	2.9	30.649
1913	6	76.0	.688	2.6	31.299
1914	6	77.7	.729	2.6	31.741
1915	6	77.5	.709	3.2	33.917
1916	6	76.3	.717	2.5	32.876
1917	6	75.8	.680	2.9	35.607
1918	6	76.5	.716	2.4	34.787
1919	6	77.0	.734	2.3	30.569
1920	6	77.7		[17] 2.4	28.335
1921	6	78.0		[18] 2.3	32.976
1922	6	78.3		[19] 2.5	32.148
1923	6	77.5		2.5	28.687
1924	6	78.3		2.6	33.722
1925	6	81.8		2.4	33.352
1926	6	77.7		2.2	30.438
1927	6	79.3		2.0	27.894
1928	6	76.2		3.0	31.927
1929	6	78.2		3.4	33.817
1930	6	78.2		3.1	33.319
1931	6	76.8		2.7	33.332
1932	6				
15-year average, 1917–31		77.8		2.6	32.061

Dalhart, Tex.; lat. 36°20′; elevation 4,000 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1908	8	66.2	0.378	8.7	55.930
1909	8	66.3	.342	8.6	59.402
1910	8	67.7	.329	8.0	57.632
1911	8	70.0	.360	8.6	59.210

[1] Mean of 4 months, June, July, August, and September.
[2] 4 months, June–September.
[14] Mean of 5 months, April, May, June, July, and August.
[15] Prorated for 6 months.
[16] April missing, 17 years average taken.
[17] Certain days missing in September. Prorated for full month.
[18] Certain days missing in April and July. Prorated for full month.
[19] Certain days missing in July. Prorated for full month.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Dalhart, Tex.; lat. 36°20′; elevation 4,000 feet—Continued

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1	2	3	4	5	6
1912	8	65.8	0.352	8.1	53.910
1913	8	69.0	.471	7.2	56.270
1914	8	67.3	.410	7.1	50.727
1915	8	66.2	.445	6.3	46.626
1916	8	67.8	.410	8.3	55.807
1917	6	67.0	.368	8.7	57.396
1918	6	67.7	.424	8.0	54.569
1919	6	67.2	.432	6.3	45.148
1920	6	65.7	.402	6.9	46.240
1921	6	67.5	.393	6.5	44.473
1922	6	69.7	.365	6.0	49.746
1923	6	67.5	.405	6.0	43.357
1924	6	66.8	.364	5.8	48.732
1925	6	69.3	.434	5.4	45.369
1926	6	66.5	.409	5.5	42.617
1927	6	68.3	.455	5.9	48.413
1928	6	66.7	.399	6.0	43.580
1929	6	67.2	.399	6.5	46.320
1930	6	69.3	.375	6.1	55.351
1931	6	68.2	.374	5.8	49.580
1932	6	68.3	.369	5.6	50.601
15-year average, 1917–31		67.6	.400	6.4	48.079
20-year average, 1913–32		67.7	.405	6.5	49.046

Dickinson, N.Dak.; lat. 47°00′; elevation 2,543 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1908	8	58.2	0.292	7.1	33.375
1909	8	56.8	.360	6.7	29.518
1910	8	57.8	.293	6.7	36.158
1911	8	55.5	.299	8.0	36.441
1912	8	56.0	.326	7.4	28.988
1913	8	58.2	.355	7.3	33.870
1914	8	57.8	.363	7.0	31.139
1915	8	55.8	.341	6.4	26.628
1916	8	56.3	.343	6.7	27.081
1917	6	56.5	.295	6.0	36.679
1918	6	57.3	.329	6.8	32.362
1919	6	62.2	.319	6.4	44.629
1920	6	56.5	.318	5.7	30.042
1921	6	58.7	.334	6.6	36.104
1922	6	58.5	.355	5.4	31.990
1923	6	58.0	.379	4.9	30.072
1924	6	53.7	.330	5.3	29.577
1925	6	58.8	.404	5.8	36.439
1926	6	57.8	.338	6.4	36.173
1927	6	55.7	.369	6.2	28.317
1928	6	56.2	.326	4.4	30.663
1929	6	56.0	.313	5.6	35.939
1930	6	59.0	.313	6.3	38.963
1931	6	59.8	.320	6.3	41.501
1932	6	59.3	.361	5.9	36.029
15-year average, 1917–31		57.6	.336	5.9	34.630
20-year average, 1913–32		57.6	.340	6.1	33.790

Edgeley, N.Dak.; lat. 46°20′; elevation 1,468 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1908 [20]	8	61.4	0.374	7.1	[21] 28.621
1909	8	57.5	.376	6.9	28.047
1910	8	59.2	.319	7.8	35.096
1911	8	58.0	.348	7.2	32.393
1912	8	56.7	.384	4.3	25.950
1913	8	59.5	.373	6.3	29.220
1914	8	58.5	.393	6.4	29.189
1915	8	56.0	.353	6.1	26.053
1916	8	57.3	.392	7.0	25.562
1917	6	56.8	.340	6.5	31.632
1918	6	57.2	.343	7.0	30.271
1919	6	58.3	.422	7.1	30.097
1920	6	57.3	.372	5.9	27.185
15-year average,[22] 1917–31		57.7	.377	6.3	29.290

Garden City, Kans.; lat. 38°00′; elevation 2,836 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1908	8	69.2	0.400	10.2	56.132
1909	8	68.2	.417	8.8	51.563
1910	8	68.0	.437	8.3	48.408
1911	8	70.5	.389	10.4	58.021
1912	8	67.0	.394	9.2	53.077
1913	8	70.0	.365	9.9	54.525
1914	8	70.8	.421	9.0	52.691
1915	8	65.3	.457	7.5	41.756
1916	8	67.8	.378	8.9	57.459
1917	6	66.8	.385	8.6	54.823
1918	6	68.5	.376	8.7	54.111

[20] Mean of 5 months, May, June, July, August, and September.
[21] 5 months, May–September.
[22] Computed by ratios of Ardmore, Dickinson, and Mandan.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Garden City, Kans.; lat. 38°00′; elevation 2,836 feet—Continued

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1	2	3	4	5	6
1919	6	69.0	0.436	8.9	51.493
1920	6	66.3	.417	8.4	51.199
1921	6	69.3	.505	6.7	53.351
1922	6	70.2	.411	8.6	57.473
1923	6	67.7	.456	8.6	47.904
1924	6	66.7	.400	8.8	53.326
1925	6	71.0	.426	8.8	58.754
1926	6	68.2	.459	8.4	55.912
1927	6	68.8	.436	9.3	56.598
1928	6	66.3	.427	8.2	50.970
1929	6	68.5	.431	8.6	53.891
1930	6	70.5	.415	8.4	61.562
1931	6	70.2	.397	8.8	58.715
1932	6	70.3	.421	9.3	56.601
15-year average, 1917–31	----------	68.5	.425	8.5	54.672
20-year average, 1913–32	----------	68.6	.421	8.6	54.156

Havre, Mont.; lat. 48°40′; elevation 2,505 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1916	6	56.7	0.303	5.3	30.558
1917	6	57.3	.268	4.8	34.638
1918	6	58.3	.244	4.9	36.473
1919	6	61.0	.290	5.4	39.980
1920	6	57.7	.281	5.8	36.985
1921	6	58.3	.278	6.1	38.302
1922	6	59.5	.290	5.8	34.390
1923	6	58.2	.319	5.2	32.505
1924	6	57.2	.293	5.5	33.097
1925	6	58.8	.299	5.0	30.629
1926	6	58.2	.276	5.6	36.078
1927	6	55.7	.313	5.3	27.790
1928	6	57.2	.290	5.5	32.056
1929	6	57.2	.252	5.0	34.693
1930	6	60.8	.282	6.2	41.273
1931	6	59.6	.266	5.9	43.921
1932	6	59.5	.300	6.4	37.809
15-year average, 1917–31	----------	58.2	.283	5.5	35.321

Hays, Kans.; lat. 39°00′; elevation 2,000 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1908	8	67.2	0.451	7.8	44.381
1909	8	67.0	.466	7.8	47.471
1910	8	66.3	.444	7.0	43.819
1911	8	71.7	.412	10.0	59.824
1912	8	68.5	.421	8.6	46.965
1913	8	70.8	.412	9.6	58.300
1914	8	68.5	.470	7.8	47.096
1915	8	64.8	.480	6.6	33.277
1916	8	68.2	.417	8.2	50.231
1917	6	67.5	.384	8.4	50.469
1918	6	68.5	.405	7.8	47.569
1919	6	68.3	.461	7.2	40.906
1920	6	66.3	.469	7.3	39.776
1921	6	70.2	.518	7.3	44.557
1922	6	70.3	.511	7.8	47.320
1923	6	68.5	.497	8.0	42.803
1924	6	67.3	.450	7.9	48.622
1925	6	70.7	.498	7.8	48.809
1926	6	69.0	.454	8.3	52.034
1927	6	67.7	.453	7.6	42.522
1928	6	66.2	.445	7.5	42.308
1929	6	68.3	.452	8.1	43.737
1930	6	69.8	[23] .453	[24] 7.9	[25] 46.372
1931	6	70.5	.446	8.0	52.271
1932	6	69.8	.495	7.5	46.314
15-year average, 1917–31	----------	68.6	.480	7.8	46.011
20-year average, 1913–32	----------	68.6	.458	7.8	46.269

Hettinger, N.Dak.; lat. 46°00′; elevation 2,253 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1911	6	58.0	0.310	7.6	44.653
1912	6	57.2	.341	6.8	29.597
1913	6	58.6	.337	7.4	[26] 35.390
1914	6	57.3	.348	6.9	32.751
1915	6	55.3	.358	6.0	25.495
1916	6	56.3	.356	6.1	27.854
1917	6	56.8	.325	8.4	32.606
1918	6	58.0	.362	6.0	34.975
1919	6	61.8	.382	5.6	39.047
1920	6	57.8	.365	5.7	29.326
1921	6	61.0	[27] .352	6.0	34.252
15-year average,[22] 1917–31	----------	58.3	.359	6.0	32.42

[22] Computed by ratios of Ardmore, Dickinson, and Mandan.
[23] April, May, June, July missing. Average 1907–32 (25 years data).
[24] April, May, June, July missing. Average 1908–32 (24 years data).
[25] April, May, June, July missing. Prorated for 6 months by average 1908–32.
[26] September missing. Average of 10 years data. Prorated for 6 months.
[27] September average 1911–20.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Lawton, Okla.; lat. 34°35′; elevation 1,111 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1	2	3	4	5	6
1916	6	73.5	0.557	6.3	46.716
1917	6	73.3	.499	6.9	51.025
1918	6	75.5	.509	6.6	52.396
1919	6	72.7	.590	4.8	37.017
1920	6	72.3	.574	5.4	38.331
1921	6	75.2	.600	5.5	38.753
1922	6	75.0	[28] .560	5.0	39.563
1923	6	74.5	[29] .552	5.3	42.233
1924	6	73.2	[30] .541	5.3	43.520
1925	6	76.5	[31] .566	5.2	48.692
1926	6	73.0	[32] .554	5.0	42.641
1927	6	74.3	[30] .554	5.3	42.229
1928	6	73.0	[33] .554	5.5	40.684
1929	6	74.3	[33] .554	5.5	43.543
1930	6	76.3	[33] .554	5.4	48.124
1931	6	74.3	.692	6.0	45.632
1932	6	74.6	[32] .591	5.6	43.113
15-year average, 1917–31	----------	74.2	.564	5.5	43.626

Mandan, N.Dak.; lat. 47°00′; elevation 1,750 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1914	6	60.3	0.408	6.2	33.949
1915	6	57.5	.338	5.8	28.616
1916	6	58.5	.346	6.1	31.277
1917	6	58.0	.307	5.9	35.682
1918	6	58.2	.321	6.4	35.499
1919	6	62.3	.369	6.3	39.591
1920	6	59.8	.334	5.8	35.251
1921	6	62.2	.347	5.9	39.262
1922	6	61.8	.380	5.2	33.855
1923	6	60.5	.363	5.8	33.536
1924	6	53.6	.302	6.1	29.799
1925	6	60.5	.336	6.1	32.054
1926	6	59.8	.302	6.4	34.467
1927	6	57.2	.350	6.1	29.078
1928	6	57.3	.334	5.3	32.209
1929	6	58.7	.293	5.5	33.450
1930	6	61.0	.326	5.9	34.413
1931	6	61.5	.333	6.1	34.458
1932	6	61.2	.343	5.8	32.334
15-year average, 1917–31	----------	59.5	.333	5.9	34.175

Moccasin, Mont.; lat. 47°15′; elevation 4,228 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1910	6	57.2	0.279	6.7	40.135
1911	6	52.7	.319	6.6	32.242
1912	6	54.5	.272	6.2	28.770
1913	6	56.5	.276	6.2	31.326
1914	6	56.0	.276	6.8	32.272
1915	6	54.0	.271	6.3	28.492
1916	6	53.3	.246	7.1	35.529
1917	6	54.0	.229	7.0	37.673
1918	6	55.4	.270	5.8	[34] 30.676
1919	6	58.2	.236	7.2	43.186
1920	6	53.8	.254	6.3	32.036
1921	6	54.7	.248	6.9	32.075
1922	6	56.5	.278	6.4	34.750
1923	6	55.3	.291	5.2	31.533
1924	6	53.0	.245	6.0	31.689
1925	6	55.7	.264	6.8	34.502
1926	6	54.5	.266	6.3	33.126
1927	6	52.3	.284	6.0	29.196
1928	6	54.0	.261	6.1	37.386
1929	6	54.7	.243	6.2	35.637
1930	6	58.0	.292	5.9	34.802
1931	6	57.5	.255	6.5	38.160
1932	6	56.8	.268	6.2	35.502
15-year average, 1917–31	----------	55.2	.261	6.3	34.285
20-year average, 1913–32	----------	55.2	.263	6.4	33.977

Moro, Oreg.; lat. 45°40′; elevation 1,800 feet

Year	Diameter of pan, feet	Θ_a	V	W	E_o
1911	6	57.5	0.247	9.4	46.679
1912	6	58.3	.276	6.0	38.119
1913	6	59.3	.305	6.4	38.228
1914	6	59.7	.281	7.5	45.206
1915	6	59.3	.352	7.2	43.420
1916	6	56.2	.305	5.0	37.334
1917	6	59.7	.305	7.4	40.244
1918	6	60.7	.276	7.5	45.276
1919	6	59.5	.264	6.1	43.951
1920	6	58.7	--------	7.5	42.20

[28] September=average 11 years data.
[29] =average 7 years data; May=average 9 years data; June=average 11 years data.
[30] April=average 7 years data; May=average 9 years data.
[31] April=average 7 years data; May=average 9 years data; June=average 11 years data; July=average 12 years data.
[32] April=average 7 years data.
[33] Year=average 11 years data.
[34] May missing. Mean of 23 years data used for May.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Moro, Oreg.; lat. 45°40′; elevation 1,800 feet—Continued

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1	2	3	4	5	6
1921	6	58.8		6.6	42.18
1922	6	59.7		8.6	47.13
1923	6	60.2		6.8	42.50
1924	6	60.7		8.4	52.34
1925	6	61.3		6.6	42.37
1926	6	61.5		7.7	48.45
1927	6	59.0		6.8	40.44
1928	6	60.2		8.8	45.41
1929	6	60.5		8.7	43.45
1930	6	61.1		9.9	43.70
1931	6	61.3		8.5	43.90
1932	6				
15-year average, 1917–31		60.2		7.7	44.236

North Platte, Nebr.; lat. 41°20′; elevation 2,841 feet

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1908	8	63.7	0.424	8.1	41.936
1909	8	62.8	.425	7.4	40.423
1910	8	64.0	.386	8.4	46.564
1911	8	65.2	.415	9.0	49.702
1912	8	62.8	.406	7.8	41.678
1913	8	66.2	.426	8.3	51.456
1914	8	66.5	.432	7.7	47.436
1915	6	61.3	.411	6.5	35.469
1916	6	63.8	.384	7.5	43.603
1917	6	62.2	.392	7.3	40.578
1918	6	63.8	.392	7.3	41.849
1919	6	65.0	.418	6.7	40.126
1920	6	62.5	.382	6.1	36.376
1921	6	65.8	.415	7.0	42.782
1922	6	66.2	.421	6.6	40.973
1923	6	62.6	.424	6.3	34.209
1924	6	61.8	.368	7.4	38.705
1925	6	66.0	.404	7.2	41.512
1926	6	64.6	.400	6.9	42.229
1927	6	63.2	.390	7.2	36.476
1928	6	62.2	.386	6.6	37.681
1929	6	64.2	.406	7.0	38.128
1930	6	65.5	.408	6.3	35.364
1931	6	66.3	.394	6.7	45.897
1932	6	66.5	.417	7.9	43.729
15-year average, 1917–31		64.1	.400	6.8	39.326
20-year average, 1913–32		64.3	.404	7.0	40.729

Sheridan, Wyo.; lat. 44°40′; elevation 3,790 feet

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1917	6	57.5	0.277	5.1	[35] 37.027
1918	6	58.5	.316	4.4	31.567
1919	6	63.5	.265	4.8	43.663
1920	6	57.3	.314	4.3	30.472
1921	6	60.3	.285	5.8	39.238
1922	6	59.7	.321	3.6	31.086
1923	6	59.3	.318	4.1	31.581
1924	6	56.7	.272	3.6	29.424
1925	6	60.3	.312	4.0	37.840
1926	6	59.3	.284	4.0	33.499
1927	6	56.3	.309	3.8	27.087
1928	6	57.7	.287	3.9	30.866
1929	6	58.5	.281	4.0	32.548
1930	6	62.0	.307	4.4	36.845
1931	6	62.7	.277	4.4	40.850
1932	6	61.2	.306	4.1	35.220
15-year average, 1917–31		59.3	.295	4.3	34.420

[35] April missing. Mean of 15 years data. Prorated for 6 months.

TABLE 3.—*Summary of U.S. Bureau of Plant Industry evaporation records, April–September, inclusive*—Continued

Tucumcari, N.Mex.; lat. 35°30′; elevation 4,194 feet

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1	2	3	4	5	6
1913	6	69.7	0.341	6.4	54.686
1914	6	70.2	.414	6.0	49.137
1915	6	69.0	.354	6.1	52.503
1916	6	70.7	.315	6.5	58.901
1917	6	69.8	.324	6.7	63.461
1918	6	70.8	.328	7.7	64.683
1919	6	68.5	.485	5.2	45.788
1920	6	65.2	.420	5.4	48.849
1921	6	70.0	.417	4.7	48.102
1922	6	72.3	.359	5.4	57.679
1923	6	70.5	.378	5.4	55.016
1924	6	69.8	.360	5.4	56.030
1925	6	71.5	.377	6.0	56.841
1926	6	68.8	.368	4.8	49.163
1927	6	71.5	.340	6.0	59.798
1928	6	69.8	.367	5.2	52.704
1929	6	70.0	.376	5.8	53.405
1930	6	72.2	.350	5.7	56.365
1931	6	69.8	.424	4.9	49.848
1932	6	70.5	.400	5.3	54.381
15-year average, 1917–31		70.0	.378	5.6	54.515
20-year average, 1913–32		70.0	.375	5.7	54.376

Williston, N.Dak.; lat. 48°00′; elevation 1,875 feet

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1909	8	57.0	0.409	6.3	32.586
1910	8	59.3	.306	6.6	37.981
1911	8	57.7	.315	6.9	37.105
1912	8	57.3	.346	5.8	29.078
1913	8	59.8	.356	5.8	35.479
1914	8	59.0	.378	5.0	32.205
1915	8	57.2	.336	5.7	30.454
1916	8	56.7	.345	5.8	29.940
1917	8	58.2	.358	6.0	33.143
15-year average,[36] 1917–31		58.5	.357	5.3	33.650

Woodward, Okla.; lat. 36°30′; elevation 1,900 feet

Year	Diameter of pan, feet	Θ_e	V	W	E_o
1914	6	73.7	0.482	8.5	52.647
1915	6	69.3	.500	7.2	41.662
1916	6	71.7	.462	8.0	53.926
1917	6	70.8	.441	7.8	49.865
1918	6	72.3	.442	7.2	49.779
1919	6	71.2	.535	6.8	45.321
1920	6	70.3	.493	7.7	48.150
1921	6	73.2	.518	7.0	50.613
1922	6	73.8	.516	6.6	57.813
1923	6	72.5	.515	6.9	49.111
1924	6	71.5	.472	7.0	49.219
1925	6	74.3	.572	6.5	50.953
1926	6	71.2	.557	6.6	47.769
1927	6	72.0	.539	6.7	46.098
1928	6	70.8	.488	7.5	50.480
1929	6	72.6	.508	7.8	50.802
1930	6	75.0	.483	7.4	57.840
1931	6	73.0	.462	7.2	52.983
1932	6	73.0	.516	7.3	52.130
15-year average, 1917–31		72.3	.503	7.1	50.453

[36] Computed by ratios of Dickinson, Mandan, and Moccasin.

A SURPRISING DECREASE IN RAINFALL AT THE CRITICAL PERIOD FOR CORN

By ANDREW D. ROBB

[Weather Bureau Office, Topeka, Kans.]

The amount of rainfall at the critical period of corn development determines to a great extent the resulting yield. Prof. J. Warren Smith, in his article, The Effect of Weather Upon the Yield of Corn, in the MONTHLY WEATHER REVIEW of February 1914, found that the critical period for corn in Ohio was the 30 days from July 11 to August 10; that is, the rainfall previous to July 11 did not have a very great effect upon the yield of corn and that which fell after August 10 need not be taken very seriously into account. Ohio being in the same latitude as most of the Corn Belt, the critical period of corn in that State would coincide with that of most of the corn-producing area.

At 23 of the 32 first-order stations of the Weather Bureau in the corn-producing area of eastern Kansas and Nebraska, Iowa, Missouri, Illinois, Indiana, Kentucky, and western Ohio, there is a period from July 16 to 29, when the average precipitation drops below that of either the 14 days preceding or the 14 days following. This is shown by the sums of the average daily precipitation,

corrected to the 50-year period, but not smoothed, of these stations, as given in the MONTHLY WEATHER REVIEW, Supplement No. 34. At 8 of the 32 stations the dry period comes in the 14-day period, July 30 to August 12. At 31 of the 32 stations in this section of the country the period when there is normally less rain, July 16–August 12, comes at a time when the corn is capable of using more rain to the greatest advantage.

For these 23 stations where the dry period occurs July 16–29, the average precipitation for the 14-day period, July 2–15, is 1.72 inches; for July 16–29, 1.43 inches; and for July 30–August 12, 1.59 inches. The first 14-day period has 0.30 inch more rain than the second, and 0.13 more than the third. The third period has 0.17 inch more than the second.

Professor Smith also found that when the July rainfall of these 8 States averaged less than 3.4 inches, the average yield of corn per acre was 10 bushels less than when the rainfall averaged 4.4 inches or more. On this proportion of 1 inch of rain increasing the average yield per acre by 10 bushels, since the forepart of July has 0.30 inch more rain on the average than the latter part, it would be an advantage of 3 bushels per acre to have the critical period of corn come 10 to 15 days earlier.

By either planting earlier, or developing an earlier maturing variety of corn, the crop on the 50,000,000 acres that are usually planted to corn in these States could be increased 150,000,000 bushels. At a price of 50 cents per bushel the value of the corn crop would be increased by $75,000,000.

The period July 16–29 is not only the driest of the 3 periods that have been compared but at most of the stations it is the driest 14-day period of the growing season. At Terre Haute, Ind., it is the driest from January 29 to October 7; at St. Louis, Mo., Springfield, Ill., and Indianapolis, Ind., it is the driest from February 12 to October 7, while at Cairo, Ill., it is the third driest of the year. At the remainder of the stations it is the driest 14-day period from approximately May 1 to September 1.

TABLE 1.—*Average rainfall at critical period of corn*

Stations	July 2-15	July 16-29	July 30-Aug. 12
Where the dry period is July 16-29			
Topeka, Kans	2.07	1.80	1.97
Wichita, Kans	1.62	1.29	1.68
Iola, Kans	1.81	1.62	1.73
Lincoln, Nebr	1.84	1.59	1.76
Kansas City, Mo	2.08	1.65	1.72
St. Joseph, Mo	1.99	1.36	1.72
Columbia, Mo	1.68	1.45	1.48
Hannibal, Mo	1.47	1.30	1.54
St. Louis, Mo	1.41	1.23	1.33
Sioux City, Iowa	1.76	1.55	1.56
Charles City, Iowa	1.90	1.58	1.64
Keokuk, Iowa	1.66	1.48	1.61
Davenport, Iowa	1.89	1.24	1.56
Chicago, Ill	1.58	1.44	1.47
Peoria, Ill	1.73	1.49	1.49
Springfield, Ill	1.48	1.13	1.40
Cairo, Ill	1.38	1.20	1.50
Ft. Wayne, Ind	1.79	1.41	1.63
Royal Center, Ind	2.05	1.31	1.52
Indianapolis, Ind	1.76	1.37	1.59
Terre Haute, Ind	1.55	1.30	1.42
Columbus, Ohio	1.78	1.49	1.67
Lexington, Ky	1.64	1.60	1.63
Average	1.73	1.43	1.60
Where the dry period is July 30-Aug. 12			
Concordia, Kans	1.59	1.86	1.34
Des Moines, Iowa	1.61	1.66	1.47
Dubuque, Iowa	2.19	1.56	1.45
Springfield, Mo	1.81	2.03	1.75
Evansville, Ind	1.66	1.52	1.38
Louisville, Ky	1.92	1.45	1.41
Dayton, Ohio	1.58	1.43	1.34
Omaha, Nebr	1.60	1.64	1.51
Average	1.74	1.65	1.41
Where the dry period is July 2-16			
Cincinnati, Ohio	1.47	1.49	1.54

ANALYSES OF THE PRECIPITATIONS AT MOUNT VERNON, IOWA, FOR 1932–33[1]

By LEONARD HINES

[Cornell College, Mount Vernon, Iowa, August 1933]

These analyses of the precipitations at Mount Vernon, Iowa, were made in the chemical laboratories of Cornell College by Leonard Hines, under the direction of Dr. Nicholas Knight. There were samples both of rain and of snow.

Mount Vernon is a village of about 1,700 population, exclusive of the college, and is without factories of any kind. The precipitations were collected in clean granite pans, located in an open space, away from any source of contamination and kept in glass stoppered bottles. The samples were always free from color. Under the direction of Dr. N. Knight, the precipitations here have been analyzed continuously for 25 years.

Ordinarily, after the coal fires are started in the fall, the precipitations show a small amount of sulphate. The SO_2 from the sulphur in the coal oxidizes in the air to SO_3. The past 2 years show a much smaller amount of sulphate, merely traces and less during the past year. During these years of the depression, the people have burned wood and much less coal.

We have considered 12 inches of snow the equivalent of 1 inch of rain.

Special pains were taken with the chloride determination. It has been found necessary to make a correction of 3.55 parts per million from the reading to allow for the formation of the color. In each case, 6 drops of the potassium chromate indicator were used.

The precipitations usually occur when the wind is either from the west or the south, which signifies that the salt is carried from the Atlantic Ocean or the Gulf of Mexico.

The phenol sulphonic method was used in the determination of the nitrates. In general, we followed in our analyses the sixth edition of Standard Methods of Water Analysis, published by the American Health Association.

Table 1 gives the parts of the various substances in 1,000,000 parts of the water and table 2 gives the pounds per acre. One inch of rainfall on an acre weighs 226,875 pounds.

[1] See also Analysis of the Precipitation of Rains and Snows at Mount Vernon, Iowa [1931–32], by Williams and Beddow, MONTHLY WEATHER REVIEW, May 1933, vol. 61, pp. 141–142.

TABLE 1.—*Parts per million*

No.	Date	Amount	Precipitation	Nitrates	Nitrites	Free NH_3	Alb. NH_3	SO_4	Chlorides
		Inches							
1	June 18	1.8	Rain	0.01	Trace	0.32	0.04		2.5
2	June 19	.1	do	.01		.20	.09		6.1
3	June 26	.35	do	.01		.32	.14		8.65
4	Sept. 12	.7	do	.01		.40	.09		12.75
5	do	.5	do		0.09	.28	.17		8.65
6	Sept. 20	.4	do	.02	.20	.14	.19		8.75
7	Oct. 3	.7	do	.03	.10	.21	.23		5.1
8	Oct. 10	1.0	do	.07	.11	.05	.09		5.1
9	Oct. 25	.55	do		.55	.10	.11		8.65
10	Nov. 4	.2	do	.14	.03	.30	.10		3.75
11	Nov. 8	1.0	do	.01	.09	.12	.08		1.55
12	Nov 9	.15	do						5.1
13	Nov. 12	.7	do	.04	.14	.13	.09		1.55
14	Dec 13	.7	do	.11	.08	.15	.09		8.75
15	Dec. 11	4.0	Snow	.07	.10	.04	.08		3.55
16	Dec. 23	.5	Rain		.04	.43	.04		7.1
17	Dec. 25	.7	do		.04				4.1
18	Jan. 18	.2	do	.25	.25	.08	.04		1.1
19	Jan. 27	4.0	Snow	.03	.09	.20	.32		1.55
20	Feb. 8	4.0	do	.01	.09	.08	.16		2.8
21	Mar. 19	.7	Rain	.01	.07	.09	.11		1.6
22	Mar. 20	3.0	Snow	.07	.01	.11	.09		2.9
23	Mar. 24	4.0	do	.02	.01	.17	.03		1.6
24	Mar. 29	.65	Rain	.04		.10	.07		5.1
25	Mar. 30	1.75	do	.04	.01	.09	.10		5.1
26	Apr. 5	.7	do	.07	.01	.14	.13		7.3
27	Apr. 9	.25	do	.12	.03	.17	.09		7.7
28	Apr. 13	.35	do	.03	.07	.09	.04		4.5
29	Apr. 30	.55	do	.07	.07	.14	.15		5.1
30	May 2	1.25	do	.07	.15	.09	.11		5.1
31	May 5	.6	do	.09	.13	.05	.07		1.55
32	May 7	.75	do	.02	.09	.15	.14		5.1
33	May 12	1.4	do	.04	.03	.30	.04		2.05
34	May 15	.2	do	.07	.07	.04	.19		2.4
35	May 16	.45	do	.11	.07	.09	.07		2.4
36	May 18	.25	do	.10	.10	.13	.30		8.2
37	May 19	.7	do	.04	.06	.09	.17		7.55
38	May 20	.5	do	.11	.03	.04	.09		2.4
39	May 21	.25	do	.07	.09	.11	.08		2.3
40	May 26	.35	do	.11	.07	.04	.06		3.6
41	May 27	.40	do	.06	.09	.09	.10		5.5
42	May 30	.65	do	.06	.09	.03	.10		5.0
43	June 4	.7	do	.07	.03	.11	.07		2.8

TABLE 2.—*Data from table 1 converted to pounds per acre*

[1 inch of rain over 1 acre=226875]

No.	Nitrates	Nitrites	Free NH_3	Alb. NH_3	Sulphur	Chlorides
1	0.004083		0.130680	0.016335		1.020937
2	.000226		.004537	.002041		.138390
3	.007940		.019009	.011116		.686861
4	.001588		.063524	.014293		2.024853
5		0.010209	.031762	.019284		.981230
6	.001815	.018150	.012705	.017242		.794062
7	.004764	.015880	.015881	.036526		.809941
8	.015881	.024956	.011343	.020418		1.157062
9		.068629	.012477	.013725		1.079155
10	.006352	.001361	.013613	.004537		.170156
11	.002268	.020418	.027425	.018150		.351656
12						.073558
13	.006352	.022233	.020645	.014293		.246158
14	.017469	.012705	.023821	.014293		1.389605
15	.005293	.006806	.003025	.006050		.268468
16		.004537	.048777	.004537		.805402
17		.006352				.651129
18	.011343	.011343	.003630	.001815		.049912
19	.002268	.006806	.015125	.024200		.117218
20	.000756	.006806	.006050	.012100		.211750
21	.001588	.011116	.014293	.017469		.254099
22	.003970	.000567	.006249	.005104		.164515
23	.001512	.000756	.012856	.002268		.121000
24	.005898		.014746	.010322		.752026
25	.015881	.003970	.035732	.039703		2.024863
26	.011116	.001588	.022233	.020645		1.159327
27	.006806	.001701	.009642	.005104		.436736
28	.002382	.004764	.007146	.003176		.357327
29	.008734	.007940	.017469	.018717		.636383
30	.019851	.042534	.025523	.031195		1.446329
31	.012251	.017696	.006806	.009528		.210993
32	.003403	.015314	.025523	.023821		.867800
33	.012705	.008507	.095287	.012705		.651131
34	.003176	.003176	.001815	.008621		.108900
35	.011230	.007146	.009188	.007146		.245023
36	.005671	.005671	.007373	.017015		.465095
37	.006352	.009528	.014293	.026998		1.199030
38	.012478	.003403	.004537	.010209		.108900
39	.003970	.005104	.006239	.004537		.130453
40	.008734	.003176	.003176	.004764		.285861
41	.009075	.008167	.008167	.009075		.499125
42	.008848	.013272	.004424	.014746		.737340
43	.011116	.004764	.017469	.011116		.444673

EXCESSIVE RAIN AND FLOOD IN THE LOS ANGELES, CALIF., AREA

By LAWRENCE H. DAINGERFIELD

[Weather Bureau Office, Los Angeles, Calif., Mar. 23, 1934]

A pressure distribution developed over the Pacific Ocean on December 29, 1933, closely resembling the "Westerly type" as defined by Thomas R. Reed in the MONTHLY WEATHER REVIEW of December 1932. During the following 4 days the pressure map was similar to Reed's "Westerly type" of December 22, 1931–January 2, 1932, which was attended by moderately heavy rain over the Los Angeles area on December 26, 28, and 29, 1931, and heavy-to-excessive precipitation over coastal areas to northward.

The disturbances of December 1931 and December 1933 possessed another common characteristic, namely, the appearance in each instance of a greatly modified depression some hundreds of miles inland, east or southeast of the parent storm, during the closing period of the major cyclone but with this difference. In the case of the 1931 disturbance, the subsequent modified depression appeared over Utah, western Wyoming, and western Colorado, while in the latter case the succeeding disturbance was over Arizona and New Mexico. Whether or not the succeeding disturbances were the "sheared-off tops" of the much vaster ocean cyclones, described by E. H. Bowie as applicable to, and accounting for, the reappearance LOWS of Alaskan Gulf depressions to the east or leeward of the near-coastal mountain ranges of Alaska and British Columbia, or possibly "secondaries" or even new developments, it is difficult to know with certainty.

In the case of the Los Angeles storm of December 1933, which was of the North Pacific type described by Dean Blake,[1] the breaking down, or far southward movement, of the protecting North Pacific HIGH is obvious, with one remnant near the Hawaiian Islands and another portion over Lower California, Sonora, and Sinaloa, Mexico, facilitating the southern extension of the Alaskan Gulf disturbance over the Pacific Ocean to somewhat below the latitude of Los Angeles. This movement was attended by a warm, moist front, believed to have had its origin over tropical or semitropical waters.

Under this pressure distribution, the rather localized, but moisture-bearing, warm front advanced northeastward or northward from its tropical or semitropical origin and crossed the coast line of Los Angeles, Orange, and the upper extremity of San Diego Counties.

The precipitation, generally, was only moderately heavy over the coastal area named, ranging from 2 to 4 inches, except from Santa Monica westward, where the abrupt, steep southerly slope of the Santa Monica Mountains, dropping sharply to the sea, exerted a profound influence, referred to later, on the rain-bearing wind.

Before the moist air reached the slopes of the San Gabriel and San Bernardino Mountains, however, it was underrun by a cold easterly wind which, obviously, largely increased the rainfall over the valley lands and lower foothill regions between the coast and mountains. In this connection Floyd D. Young, in charge of the Pacific Coast fruit-frost work of the Bureau, with head office in Pomona, Calif., says:

> So far as the local area around Pomona is concerned, I believe the general conditions which prevailed here throughout the storm period were practically the same as those in Los Angeles. The outstanding feature of the storm here, or at least the feature which impressed me most forceably, was a strong, relatively cool, sus-

[1] MONTHLY WEATHER REVIEW, 61, 223, 1933.

tained surface wind, which continued from an easterly direction throughout the rainfall period. Most of the time this wind was from the east or northeast, but shifted to the southeast for short periods. This fact, as well as the fact that the rainfall was heaviest along the lower foothills, with, in many cases, considerably lighter rainfall in the higher mountains, leads me to believe that the orographic influences, except insofar as they may have affected the surface wind direction, were considerably less important in this storm than in most other rainstorms which have occurred here in the past. In other words, it appears to me that the strong and sustained southerly and southwesterly air currents, which prevailed from moderate to high elevations, as shown by pilot-balloon observations, began to rise over the relatively cold easterly currents at lower elevations considerably before the mountains were reached, and that the precipitation of the moisture was due not only to the rising of the southerly air currents, but also to a certain extent at least to the mixing with the relatively cold surface easterly wind.

The surface wind at Los Angeles also, like that at Pomona, had a strong easterly component during the precipitation period, December 30 to January 1, inclusive. The courses of the clouds, drifts of pilot balloons, and records at the higher level stations indicate, however, that the cool, underrunning easterly winds had no great depth during the progress of the storm. The southerly component was more pronounced at the higher levels, especially during the period of the heaviest precipitation, in keeping with the believed warm source of the moisture (tropical or subtropical).

Examination of the isohyetals for the storm shows centers of heaviest total rainfall at Hoegee's Camp, San Gabriel Mountains, elevation 2,650 feet, 19.91 inches; Opid's Camp, same mountains, elevation 4,254 feet, 17.93 inches; Squirrel Inn, San Bernardino Mountains, elevation 5,700 feet, 12.55 inches; Lytle Creek, in Lytle Creek Valley, between the mountain ranges named, elevation 2,250 feet, 13.44 inches; Malibu Headquarters, Topanga Canyon, Santa Monica Mountains, elevation 747 feet, 16.03 inches; Mount Wilson, loftiest reporting station in the San Gabriel Mountains, elevation 5,850 feet, 15.58 inches; and Big Bear Lake Dam, loftiest reporting station in the San Bernardino Mountains, elevation 6,800 feet, 10.30 inches. There undoubtedly is marked orographic influence on precipitation at all of these centers of excessive rainfall. Further examination of the isohyetals, however, shows that there were local areas of heavy rainfall in the valley and foothill regions adjacent to the San Gabriel Mountains, the Verdugo Hills, and Griffith Park in Los Angeles. Some of the wet-center, lower-elevation stations are: In the San Gabriel foot-hill area: Flintridge, above Glendale, 14.92 inches; Sunset Reservoir, above Pasadena, 14.95 inches; Azusa, 16.29 inches; Griffith Park Nursery, Los Angeles, 14.72 inches. Riverside, shadowed by the Box Springs Mountains on the east and southeast, received a total of only 1.74 inches, while Long Beach, San Pedro, Palos Verdes estates, on the immediate coast, received only 2.87, 2.20, and 2.25 inches, respectively. Table Mountain, elevation 7,500 feet, north of and in the shadow of the San Gabriel Mountains, recorded only 3.58 inches.

In the valley-foothill regions, both the topographic and underrunning cold air influences are apparent.

A suggestive fact incident to the history of the storm was that the initial precipitation at certain high-level stations located in the upper reaches of the San Antonio Canyon, San Gabriel Mountains, and in the vicinity of Lake Arrowhead, San Bernardino Mountains, was in the form of snow. This was followed, shortly, by heavy rain, when the precipitation was at its greatest intensity, harmonizing with the belief in the tropical or semitropical source of the moisture-bearing winds.

Despite the undoubted rain-producing factor involved in the underrunning cold easterly wind and the overrunning warm southerly currents, a highly significant feature of the storm, demonstrating pronounced and dominant orographic influences, was the fact that the precipitation was heaviest where the rain-bearing winds ascended directly rather steep valley floors and the steeper slopes of the foothills—the Verdugo Hills, the Santa Monica, San Gabriel, and San Bernardino Mountains. This is in harmony with studies on mountain influence in rain-production elsewhere. Cherrapunji, elevation 4,455 feet, on the southern slope of a front range of the Himalaya Mountains, near the head of the Bay of Bengal, presenting its steep incline to the summer monsoon winds, and Mount Waialeale, island of Kauai, Hawaii, elevation 5,075 feet, with its almost vertical slopes, facing the prevailing Trades, show striking examples of mountain influences in the interception and lifting of "head-on" rain-bearing winds with well-known results.

Occasionally we find instances of heavy rain being carried over the summits of mountain ridges from the wet windward side, for a mile or so to leeward, as illustrated by the phenomenal catch of 17.91 inches during the storm under discussion at Opid's Camp, near the head of the West Fork of the San Gabriel River, back of Mount Wilson.

Returning to the study of the excessive rainfall over the Los Angeles area, December 30–January 1, we find additional evidence of pronounced orographic influence by comparing the amount of precipitation over the region named with the catch over the San Diego area, immediately to the southeastward. The hill and mountain ranges in the Los Angeles area generally extend east and west, or at right angles to the rain-bearing winds of this storm, resulting in maximum efficiency in rain production from these southerly winds. On the other hand the mountains back of San Diego trend generally north-south and therefore are least efficient as rain makers when the moisture-bearing winds are from the south, as in this case. The fact that the Los Angeles area was subjected to excessive rainfall while the San Diego sector received only nominal amounts is highly suggestive of the prominence of the orographic influence.

The presence of vast beds of gravel and boulders in the stream washes of southern California valley lands is striking evidence of former floods. In fact the whole valley area is a picture of sand, silt, clay, gravel, and larger rock fragments, all telling the erosive story of the past. Surveys by the writer of the terrain flooded by the December storm show vast deposits in places in La Crescenta, Montrose, and, to a somewhat less extent, in parts of Glendale and elsewhere, with occasional marked erosion by the rushing water over the areas named.

An unfortunate preliminary to the flood was the brush and forest fire, originating on November 23, 1933, which burned over 4,850 acres extending from Haines to Halls Canyon and mountainward to the Mount Lukens (Sister Elsie Peak) Divide. This fire-devastated area lies immediately back of and above a large part of the later-flooded area in the La Crescenta-Montrose sector. That area of Glendale which was subjected to flood lies below a portion of the Verdugo Hills which was burned over as recently as December 1927.

It is estimated that the erosive scourings in the steep walls of the burned-over area reached depths as great as 12 feet in some localities as a direct consequence of the rain and resultant flood. It is further estimated that the flood waters, in certain areas, carried as high as 75 percent solid matter in the form of mud, sand, gravel, boulders, etc. It would seem, however, that there must have been wide exceptions to the rule regarding the heavy charge of

solid matter, in view of the fact that splashes of muddy water have been observed as much as 15 feet above a flood crest surface, thus indicating a flow velocity of about 30 feet per second. Such a velocity is not in harmony with a stream carrying as much as 75 percent solid matter. Moreover, it is said that the flood water, in a certain instance, showed marks as much as 15 feet higher on the outer portions than on the inner or shorter sectors of the curved stream course, thus indicating extremely high velocities. At no place was the tremendous force of the flood better demonstrated than near the head of New York Avenue in La Crescenta, where a boulder estimated to weigh at least 40 tons was brought down the side of the mountain in the background and deposited on the street. At another point, a rock some 87 inches in length was deposited in the forks of a sycamore tree about 4 feet above the ground. Myriad boulders of enormous size were projected by the flood waters, in some instances, no doubt, miles from their previous locations, adding materially to the death and destruction from the storm, while in transit.

The following quotation on the run-off and erosion incident to this storm is taken from a recent report made by the United States Forest Service:

From records gathered under the direction of C. J. Kraebel, senior silviculturalist of the California Forest Experiment Station, on experimental plots located in the San Dimas Canyon, during the storm of December 30–January 1, last, it was found that the run-off on burned watersheds was approximately 41 times that on unburned areas, and that the rate of erosion on denuded areas was 1,245 pounds per acre, compared to 68 pounds per acre where the watershed was protected by chaparral.

These comparisons, based on accurate records, according to Forest Service officials, exceed previous estimates and tend to emphasize the value of plant growth on watersheds and explain the reason for the loss of life and property damage following the Pickens Canyon fire of last November.

Other data compiled by C. J. Kraebel estimates the run-off from the partly burned Verdugo watershed as 50 times as great as in the Arroyo Seco and San Dimas Canyons, where the chaparral is intact.

In this connection, however, it is well to call attention to the fact that the west end of the Verdugo Hills, which was burned over by the fire of December 1927, failed to show phenomenal run-off, while the east end of the same range, with a good chaparral cover and unaffected by material fires during the last 25 years, had a very high run-off.

Greatest 10-minute intensities over and above the devastated La Crescenta-Montrose-Glendale areas appear to have been shortly before or after midnight of December 31–January 1; 30-minute intensities, same hours, but with some variations from late afternoon of December 31 to shortly after midnight of January 1; 1-hour intensities, somewhat wider variations from midafternoon of December 31 to after midnight, with a distinct tendency toward a secondary high hourly intensity between midnight and 2 a.m. of January 1, where greatest hourly intensities had occurred before midnight; 2-hour intensities, similar to the hourly intensities, with a tendency toward a slightly wider spread in time; 12-hour greatest intensities generally ended from somewhat before midnight of the 31st–1st, to near 2 a.m. January 1, 1934.

FLOOD PEAKS

Haines Canyon (1 mile above mouth): Flood increased rapidly at 11:30 p.m., December 31; a wall of water 8 to 10 feet high arrived at 11:50 p.m., accompanied by a loud roar, demolishing the observer's house; water fell back to the 11:30 p.m. stage by midnight.

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Blanchard Canyon mouth: Peak arrived at 11:55 p.m. of December 31, with 10-foot wall of water, lasting 4 to 5 minutes; observer was able to walk across the stream at 12:05 a.m. January 1. Somewhat farther downstream, the wall of water at 12:05 a.m. January 1, time of highest freshet was about 6 feet, lasting about 2 minutes. There were several freshets during the afternoon and evening of December 31; flood flow struck inhabited area of the Canyon about 11:40 p.m.

Cooke Canyon: Mud flow crest passed the mouth near Hillcrest Sanitarium at 11:50 p.m. December 31, and hit the C.C.C. Camp at Cooke Canyon and Verdugo Wash (about 1 mile down from mouth) at 12:10 a.m. January 1.

Wards Canyon: Flood flow arrive at 11:55 p.m. December 31, lasting 5 minutes; velocity said to be greater than a horse can run.

Shields, Eagle, and Goss Canyons: Crests arrived at mouths about 11:50 p.m. December 31; about 10 feet high in Shields Canyon, with flow lasting from 4 to 5 minutes, and hit Foothill Boulevard at 12:09 a.m. January 1 with wall of water 10 feet high; passed by 12:15 a.m.

Pickens Canyon: The flood flow, with wall of water about 10 feet high, reached mouth of Canyon at 11:50 p.m. December 31, lasting 5 to 6 minutes, and arrived at Foothill Boulevard at midnight.

Halls Canyon: The flood water passed the mouth of this canyon about the same time as Pickens Canyon—11:50 p.m. December 31, at mouth, and midnight at Foothill Boulevard.

Flood waters from Pickens, Ward, Blanchard, and Halls Canyons passed through Montrose.

The peak of the flood passed down the Verdugo Wash in Rossmoyne Addition, between Montrose and Glendale, between 1 a.m. and 1:30 a.m. January 1. At 6 p.m. December 31 the velocity of debris was 20 feet per second.

New 24-hour high-precipitation records were established at many points over the rain area; Los Angeles, as an example, with a record covering 56 years, was raised from 5.12 inches (on Feb. 23–24, 1913), to 7.36 inches (Dec. 31, 1933–Jan. 1, 1934), at the height of the storm. While the amount of rainfall for the whole storm was phenomenal, time and area considered, its short-period intensity for any particular station does not appear to have been outstanding, especially when compared with the remarkable 1-minute record of 1.02 inches, measured in two Fergusson gages, exposed side by side, at Opid's Camp (elevation 4,254 feet) back of Mount Wilson, near the headwaters of the west fork of the San Gabriel River, at 4:48 a.m. April 5, 1926.

On January 1, 1934, the final day of the storm, the surface winds, which had been dominantly from the east and southeast, veered through the south to southwest, as relatively high pressure was reestablished over the Pacific coastal areas of this latitude, bringing the precipitation to a close. The rain was prolonged somewhat north and northeast of the San Gabriel Mountains, over the Antelope Valley, Mojave Desert, even to the Death Valley area, during the afternoon and evening of January 1. The precipitation, over the desert areas on the date named, although heavy at times, was generally of short duration, frequently attended by thunderstorms, as observed by the author.

CONCLUSIONS

1. The Pacific HIGH largely broke down, with a modified fragment somewhat to the east of the Hawaiian

Islands and another over the States of northwestern Mexico.

2. The North Pacific-Alaskan Gulf LOW, in the absence of the shielding Pacific HIGH in central and southern California latitudes, spread far southward, bringing the coastal area under its influence.

3. The pressure distribution was of sufficient duration and proper kind to bring winds to the southern California coast from tropical or subtropical sources, considerably above the normal winter warmth of this latitude and high in moisture content.

4. While the underrunning easterly wind (at and near the surface of the valley lands) was comparatively cold and shallow, the resulting uplift of the overrunning Pacific "Tropical warm front" advancing from the south was sufficient to cause chill and to precipitate moisture.

5. *The mountains were a dominant and deciding factor in the heavy to excessive rainfall production.*—Had there been no intercepting east-west ranges in the path of the warm, moist front, advancing from the south the rainfall would not have been excessive. Impressive confirmation of this conclusion is the fact that winds paralleling the north-south mountains back of San Diego brought only moderate precipitation while heavy to excessive rainfall occurred adjacent to and over the east-west foothills and mountains of the Los Angeles area.

The property losses caused by this flood approximated $5,000,000, while there were 45 known deaths and a large number of injured people. Destruction of homes and automobiles and injury to the land and highways accounted for the major property losses.

METEOROLOGICAL CONDITIONS ATTENDING THE HEAVY RAINFALL IN THE LOS ANGELES, CALIF., AREA, DECEMBER 30, 1933, TO JANUARY 1, 1934, INCLUSIVE

By GEORGE M. FRENCH

[Weather Bureau Airport Station, Burbank, Calif., Apr. 18, 1934]

A pressure situation developed during the closing days of December 1933, in which a depression of considerable intensity was located on the 5 p.m. P.S.T. synoptic map, December 28, with the center located at about 48° N. latitude and 133° W. longitude.

The evening synoptic chart of December 28 shows an energetic and rather wide-spread flow northward of tropical Pacific air (hereinafter designated by initials TP), aided by the anticyclone near Lower California. While observations of upper-air winds are not available off the coast, this northward flow is inferred to be aloft in that region as well as on the surface. Upper-air winds show this flow over most of the western portion of the United States.

Temperatures were generally lower on the land surfaces from San Francisco Bay area northward than off the coast and in general surface winds over the land had a more easterly component than those at sea. This, together with the general steady rain along the coast from the San Francisco Bay district northward, indicated the presence of a warm front. In studying the data available it appears that the warm front was located along a line eastsoutheast from the center of the depression to some point near the Washington coast thence curving southeastward just off the coast to some point somewhat beyond the San Francisco Bay district.

Only a limited number of ship reports are received at this station (Los Angeles) in the preparation of our daily charts. For the purpose of this study additional ship reports were furnished by the San Francisco Weather Bureau office. Some temperature records were also furnished from the San Francisco office for Avalon, Catalina Island, and the San Diego office furnished some temperature, rainfall, and wind-direction records obtained from the Navy for San Nicholas Island. With this additional information a wind shift or cold front was located extending south-southeastward from the center of the depression to about latitude 30° N.

It is believed that little proof is needed in order to accept the statement that TP air lay to the eastward of this shift line. It is further believed that Transitional Polar Pacific air (hereinafter designated NPP) was in rear of this shift. The proof of the existence of NPP air in rear of the wind shift is not nearly so obvious, but despite meager information we have some indications that may be used as factors of proof.

First, it must be understood that any type of air, whether it is TP, PP (Polar Pacific), or PC (Polar Continental) cannot have a long history over the water without the air close to the surface taking on a temperature near that of the water. Therefore, PP air moving into southern latitudes over the water is likely to have a temperature near the surface close to that of TP air moving northward into the same latitude. In the case of the cold front referred to above, the temperature was actually higher in some cases on the west side than it was on the east side of the wind shift. This is believed to be due to the fact that the water is warmer some distance out from the coast than it is in the regions nearer the coast.

It is now evident that the lack of temperature discontinuity on the surface over the water is not proof of the nonexistence of a front and we will therefore have to look for other properties that may help identify the air mass. As indicated before a flow of TP air northward will result in the lower portion of the air being cooled and thus rendered more stable, but in the case of the PP air moving southward the reverse is true, namely, the air near the surface is being warmed and instability is increased. Therefore steep lapse rates should be encountered in the case of NPP air, giving rise to rain of the shower type while small lapse rates should be encountered in the TP air without rain unless other mechanical means are employed in raising the air mass to higher levels.

Again referring to the wind shift on the evening map of the 28th, the ship *Mojave* appeared to be located approximately on the shift line and the report showed showers. There were no other ships on or very near this shift, as I have it located, and therefore we have only the one report. Even the one report could be considered a rather strong factor, I believe, in identifying the air mass to be NPP as northward flowing TP air practically precludes showery weather. Further indications will be given later as we trace this front into the Los Angeles area.

The morning map of December 29 showed that the wind shift had moved much closer to the coast, having probably reached the coast and occluded north of San Francisco, indicated by the fact that steady rain had stopped at Eureka and the occurrence of a thunderstorm during the following 4 hours at Redding, showing the presence of more unstable air. The warm front showed signs of extending farther down the coast as the ceilings were

lowering south of San Francisco and cirrus clouds were increasing in the Los Angeles area merging into altostratus and altocumulus clouds later in the day. The following 4-hour map showed rain south of San Francisco to about San Luis Obispo, still apparently of warm front type.

There were not sufficient well-located ships charted on the evening map of December 29 to enable one to locate definitely the position of the wind shift, but it appears probable that the occluded front lay over the interior of northern California and that the shift was very near the coast south of San Francisco to about Santa Barbara and a weak remainder of the southern extension somewhat farther off shore at Los Angeles. In the meantime the ceiling had lowered to 4,200 feet at Santa Barbara and 7,000 feet at Burbank. The next 4-hourly map showed rain at Santa Barbara.

On the morning of December 30 it was again impossible to locate definitely the front but it was probably very near the southern California coast and if not already occluded, it was nearly ready to become so. The Burbank reports showed still further signs of warm-front conditions and the ceiling had lowered to 5,000 feet and steady rain set in during the early afternoon between noon and 1 p.m. As stated, the front was thought to be occluding, if occlusion had not already taken place, and due to its apparent closeness to the coast it would be expected to pass the Los Angeles area during the day. The depression that had approached our coast as a very energetic one had nearly disappeared and was being followed by a new depression which showed rather rapid movement toward the coast.

During the day of December 30 the new depression continued to move southeastward and by the time of the evening map had become the dominant feature of the coastal section of California with a new wind shift some distance out to sea and a second warm front indicated along the coast as far south as Santa Barbara.

As stated above, steady rain had set in in the Los Angeles area during the early afternoon of December 30. The ceiling lowered from 4,000 feet at 1 p.m. to 500 feet at 5 p.m. followed by increasing ceiling, reaching 1,200 feet at 7 p.m. Steady rain ceased at about 6 p.m., with only occasional showers thereafter until about 11 p.m., when steady rain again resumed. The fact that the ceiling dropped to very low followed by cessation of steady rain and increasing ceiling is worthy of notice as indicating the possibility that we were at least temporarily under the influence of a different air mass and that perhaps at least a remanent of the occluded front would pass this area. The wind did not shift during this probable passage of the front but diminished considerably in velocity. It is believed that the lack of a wind shift might be explained by the fact that due to the proximity of the new energetic depression the northward flow of air had been given new vigor and the little remanent of NPP air remaining back of the occluded front had been caught up in the new flow and its identity largely lost except for a steeper lapse rate.

Now let us refer to the graph. It was thought that by means of computation, a warm-front type of precipitation might be identified from a purely orographic or instability type, by comparing the temperature and dewpoint on Mount Wilson with that temperature that would occur if the surface air was lifted to that elevation, assuming that Mount Wilson, due to its height (observation station approximately 5,800 feet above sea level), was in the warm-air layer.

The Neuhoff adiabatic diagram was used for computing the temperature for Mount Wilson. As the temperature on Mount Wilson during the storm was never lower than 36° F., the snow and hail stages do not have to be reckoned with. Furthermore, as rain was falling at all reporting stations in the valley and on the mountain slopes, I believe that we may assume that the cooling with elevation would be much closer to the pseudoadiabatic than to the adiabatic. Therefore, while such a computation cannot be considered to be exact, it is believed to be very representative.

If Mount Wilson was within the warmer air mass, as we have supposed to be the case, it appeared logical to believe that the actual temperature recorded on Mount Wilson should be higher than the adiabatic temperature for that location, using the Burbank data as a basis. As indicated by the accompanying graph, the Burbank data, the computed data for Mount Wilson, and the actual data for Mount Wilson are given for each 4 hours except at 1 a.m., at which time there were no available records for Mount Wilson. The computed temperature curve representing the temperature that should have occurred at the elevation of Mount Wilson, had the air been lifted from the valley below, was obtained by using the temperature and the dewpoint at the Burbank Airport Station. For convenience the Neuhoff adiabatic diagram was used and the values are believed to be nearly correct.

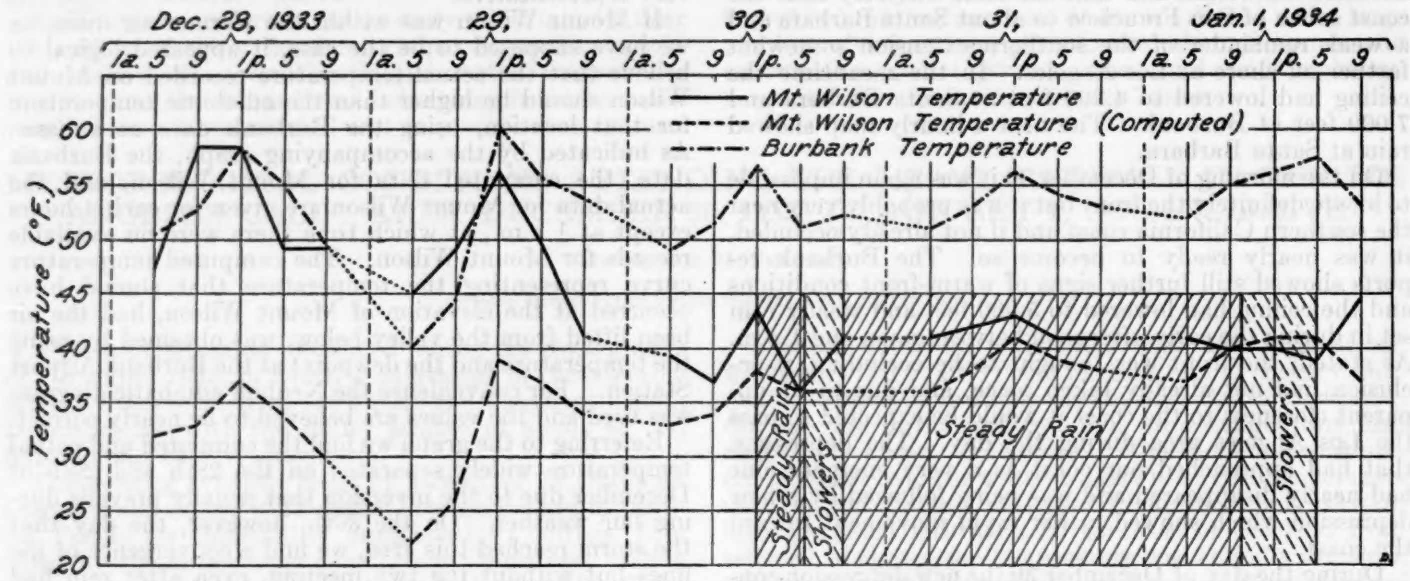
Referring to the graph we find the computed and actual temperature widely separated on the 28th and 29th of December due to the inversion that usually prevails during fair weather. On the 30th, however, the day that the storm reached this area, we find a convergence of the lines but without the two meeting, even after rain had begun. If the rain was of warm-front type, and, as we assumed Mount Wilson reached up into the warmer layer, then it would seem that the actual temperature on Mount Wilson should be higher than the computed temperature. This is true according to the graph until 5 p.m., when we find that the two lines coincide. Now let us recall that there was some indication of the passage of the occluded front over Burbank at about 5 p.m.

Furthermore, we have previously stated that if any of the NPP air actually arrived in this area as would be necessary with the passage of an occluded front, the effect should be to steepen the lapse rate. This would cause still further convergence of the two lines on the graph. This convergence has been realized, thus adding another factor of proof of the passage of the occluded front. It will be noted that the lines show divergence soon after they coincided. It was previously thought that only a remainder of the NPP air arrived in the Los Angeles area and was quickly replaced by TP air due to the influence of the second depression. The divergence of the lines therefore indicates the reestablishment of the warm front, and by 11 p.m. of the same day steady rain again set in.

With the warm front reestablished in the Los Angeles area under the influence of the second depression, the sequence of positions of the front will not be described here in detail, leading to the second occlusion. The warm front appeared to remain almost stationary along southern California coast during the 31st with the wind shift or cold front approaching. This second cold front extended to much lower latitudes than the first one did and it appeared that the Los Angeles area would be more greatly influenced by it upon its arrival.

On the morning map of January 1, 1934, it seemed probable that occlusion had taken place and some of the

colder air may have already invaded the Los Angeles area below the elevation of Mount Wilson, as rainfall was very heavy during the early morning hours, indicating greater convectivity. This was followed again on the graph by the convergence of the lines indicating steepened lapse rate, characteristic of NPP air, and from 9 a.m. to 5 p.m. the weather was showery with occasional breaks in the overcast. The winds in the meantime were shifting from southeasterly to southwesterly and west. At 9 p.m. the lines of the graph showed rapid divergence



again and as we were coming under the influence of an anticyclone it is possible air warmed by subsidence was causing the higher temperatures.

The angle formed by the line of discontinuity between the cool air mass and the warm mass above is seldom very steep, therefore it is probable that many of the mountains near the coast extended into this warm air mass as well as the higher mountains in which Mount Wilson is located. If this be the case, then orographic influences would be expected in each case where the mountains extended into the warm mass and it would appear that Daingerfield's conclusions that topography played an important role in the amount of rainfall for various localities would be justified even under the warm-front conditions.

CONCLUSIONS

Considering the storm from the standpoint of masses of air involved, there appears to have been a warm front established which started rain in the Los Angeles area, a rain soon temporarily halted by the passage of a dying occluded front, which front in turn was again quickly replaced by a new warm front that continued until the last day of the storm when occlusion again took place along the coast with the occluded front passing inland and terminating the storm.

Acknowledgments are due to L. H. Daingerfield and members of the Weather Bureau Airport Station at Burbank for their helpful suggestions and criticisms.

THE NEW ORLEANS, LA., TORNADO OF MARCH 26, 1934

By GRADY NORTON

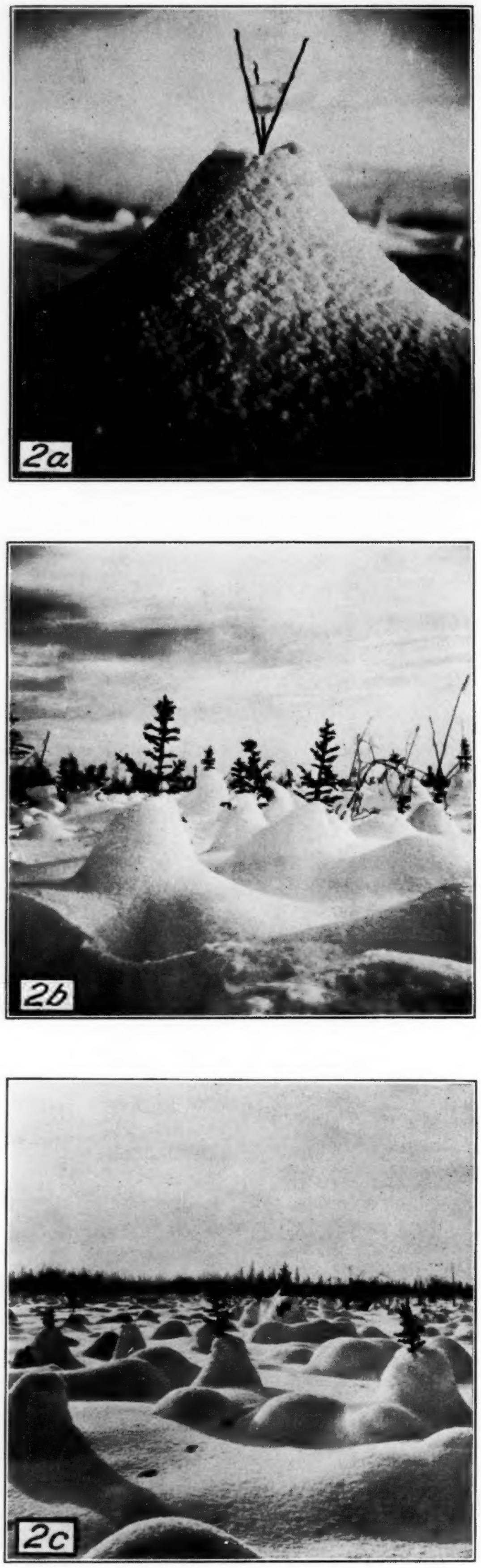
[Weather Bureau Office, New Orleans, La., Mar. 29, 1934]

A small tornado passed through the eastern portion of New Orleans at about 8:05 to 8:10 a.m., central standard time, March 26, 1934, over a path approximately 4 miles long and from 100 to 200 feet wide. Fifteen persons were injured but none killed. Sixty houses were destroyed, or virtually so, and about 50 others damaged in varying degrees. Telephone and electric wires and poles were torn down and much other damage of a minor nature done. A conservative estimate of the property loss is $150,000.

The storm moved slightly east of north, and was first noted as it crossed the Mississippi River near the wharves of the Standard Fruit Co. The port officials of this company observed it as a roll of very black cloud moving low over the river with a very strong wind on its right side. However, no appreciable damage occurred on the river front. The first evidence of real damage was noted near the intersection of St. Claude and Almonaster Avenue, where roofs of buildings were injured. From this point the storm moved out Almonaster Avenue, with varying degrees of damage, to the junction of Franklin Avenue, and thence diagonally across the triangle of blocks between Franklin and Almonaster Avenues along Eads and Deer Streets to the railroad tracks, where the last major damage occurred to the property of a city pumping station located near the intersection of Industry and Deer Streets. Slight damage occurred at intervals from this point to the Gentilly Road, but none of consequence beyond it.

The greatest destruction occurred along a path 100 feet wide, with lesser damage 50 feet farther out on either side, from the junction of Franklin and Almonaster Avenues along Eads and Deer Streets for a distance of 10 blocks. This is a residential section having mostly small, lightly constructed frame houses virtually every one of which near the center of the path was completely wrecked, while those near the edges of the path were extensively

Rime caps.



Snow cocks.

damaged. It was in this section that all the injuries occurred.

Farther on the city pumping station was considerably damaged, and beyond that practically nothing hurt as the course was then over unimproved property.

One or more persons who witnessed the storm reported that they saw a funnel-shaped cloud attending the vortex.

The extent and character of the wreckage leaves no doubt of the tornadic character of the storm, but the path was so narrow that the wreckage left showed only occasional evidence of the whirling motion of the air. Much of the damage indicated that the vortex was barely touching the earth, and that roofs were lifted or houses picked up and carried along in the direction of the storm movement and left scattered in confusion.

At the city office of the Weather Bureau about 2 or 3 miles southwest of where the storm struck, no special observation of the clouds was made near that time, but a thunderstorm attended by heavy rainfall and very thick dark clouds was in progress, the rain having begun at 7:50 a.m., or 15 minutes before the tornado occurred. The winds were not strong, the extreme gust being only about 22 miles per hour, but a well-defined shift from southeast to southwest and west occurred during the progress of the thunderstorm. Mr. C. E. Mahaffey, in charge of the Airport Station at Menefee Airport, about 3 to 4 miles east of the storm path, observed the thunderstorm cloud over the city at the time of his 8 a.m. observation, and describes it as being black in color and presenting the appearance of a squall-line front, but with a decided greenish cast underneath the black roll of the advancing squall. He did not observe the vortex cloud, but stated that it might have been obscured by falling rain. He stated that he turned on the wind velocity indicator and it registered a velocity of 60 miles per hour from the *southeast* at 8:05 a.m. as the storm approached from the west and southwest. The tornado was in progress at this time approximately 4 miles northwest of his station. This will indicate the violence of the rush of air inward and upward toward the vortex, which is much stronger than the usual uprush in front of a thundersquall in this section.

The barometers at the city office and airport station were but little affected. At the city office a very slight dip of probably 0.02 inch was noted on the barograph trace, followed by the usual rise characteristic of thunderstorms.

Other storms which have caused damage in appreciable amounts in New Orleans during the past 35 years were:

October 5, 1906.—A well-defined tornado of small size occurred in which 3 persons were killed and 21 injured. Damage, $300,000.

October 23, 1913.—Severe thunderstorm; a few persons injured. Damage, $10,000.

April 7, 1916.—Probably a tornado. Fifteen buildings damaged. Two persons killed and four others nijured. (In Gentilly section.) No money estimate of damage.

May 2, 1923.—Severe thunderstorm. Several injured; many houses damaged, but no money estimate of damage. (Milenburg, West End, and Lake Shore.)

May 19, 1923.—Incipient tornado. No one injured. Damage $25,000, principally in vicinity of Jahncke Dry Docks, where buildings were damaged.

July 24, 1924.—Doubtful, probably small tornado. River boat *Climax* was capsized; steel sheds at Jackson Avenue and River were stripped of corrugated iron sides. Damage $29,225; no deaths or injuries.

April 17, 1924.—Windsquall of almost tornadic force above Carrollton Avenue and between Oleander Street and Metairie Cemetery and in Jefferson Parish. Damage, $100,000. Fifty persons injured. Numerous houses moved from their foundations and several wrecked. Terrific hailstorm, with stones 2 to 3 inches in diameter; 3 inches deep on ground in places.

February 22, 1926.—Severe local storm, uncertain as to tornado, occurred in vicinity of Salcedo and Bienville Streets. Several persons injured; damage, $13,000.

May 16, 1930.—Severe local storm, near Royal and Piety Streets. Warehouse and other small houses damaged. No injuries.

RIME CAPS AND SNOW COCKS

Mr. R. L. Frost, Senior Observer, Weather Bureau office at Fairbanks, Alaska, has kindly sent to the Central Office a number of winter pictures. A few of these are here reproduced because of their general interest.

Figure 1*a* is the top of a ventilator pipe that had become capped with rime—granular ice incident to the solidification on contact of undercooled water droplets. The droplets in this case resulted from the chilling of the exit air to far below its dew point on mixing with the excessively cold (−50° F., or more) outer air.

Figures 1*b* and 1*c* are two views of a chimney top similarly capped with rime, as occurs at this low temperature whatever the fuel used for heating. The fuel itself, if wood, as in the present case, oil or gas, adds a considerable amount of moisture to the chimney air which must increase the rate of growth of the cap. However, as the chimney also is a ventilator it caps, as stated, at excessively low temperatures, whether water is a product of the combustion of the fuel or not.

Figures 2*a*, 2*b*, and 2*c* are several views of snow cocks formed, each, of dry snow piled by shifting winds around a small isolated tree. Similar sand cocks, of like origin though seldom so beautifully symmetrical, often are seen in arid regions.—*Editor.*

SLEET AND ICE STORM IN TENNESSEE ON MARCH 19, 1934

By R. M. WILLIAMSON

[Weather Bureau office, Nashville, Tenn., Apr. 6, 1934]

A sleet and ice storm of unusual intensity occurred over central Tennessee on Monday, March 19, 1934. This was a feature of a rather strong cyclone centered about Atlanta, Ga., at 8 a.m. (eastern standard time) of the 19th, which moved east-northeastward and caused general precipitation along the wind-shift line and for some distance westward. An all-night sprinkle turned to rain and sleet at Nashville, Tenn., at 5 a.m. of the 19th. This combination continued until 3:30 p.m., and the rain until 6:30 p.m. The total amount of precipitation on the 19th was 1.27 inches. The temperature ranged from 31° at 2 a.m. to 27° at 2 p.m. and 32° at 8 p.m. (eastern standard time). The prevailing wind was north to 10 a.m. and northwest thereafter. The maximum wind velocity was 18 miles per hour from the northwest at 3:03 p.m.

A small amount of glaze had formed by 7 a.m. and increased in thickness as long as the rain fell. In the late afternoon the coating of sleet and ice on the ground was 1 inch thick, and the glaze on trees, shrubbery, wires, etc., ½ to ¾ of an inch thick, except on the under side of wires and branches, where it was about ¾ of an inch. Icicles by the millions were suspended close together from wires, fences, bridge railings, eaves of buildings, and other horizontal objects. These were from 2 to 4 inches long on wires and as much as 10 or 12 inches on other objects, and contributed enormously to the total weight of the ice and the consequent damage. The northern walls of buildings were plastered at least half an inch thick with the ice, and in some cases as much as two thirds of an inch. Shrubbery, weeds, and grass were incased. The station anemometer showed less speed under the weight of the ice coating, and when this was removed at 2:45 p.m. the velocity showed an appreciable increase. Each cup of the anemometer had suspended horizontally from it an icicle 3 inches or more in length.

The scene presented by the ice was one of rare beauty, even during its formation when the sky was overcast and the rain and sleet falling, but early the following day, under a cloudless sky and in bright sunshine, the earth was indeed a fairyland of brilliance. Similar scenes and conditions were noted throughout the central counties of the State, the storm being particularly heavy in the area known as the Central Basin and in the upper Cumberland Valley. However, very little ice remained at sunset of the next day.

The damage was enormous, particularly to trees and telephone, telegraph, and light wires and poles. Trees as much as 18 inches in diameter were split and some were uprooted, while others were broken off near the ground. Thousands of trees had large limbs broken, many falling upon light and power lines and disrupting the services. The damage was severe to evergreen trees, including magnolia, cedar, and pine. Fruit trees suffered considerably. Fortunately, the wind diminished as the ice attained its greatest thickness and remained light throughout the night and the following day.

The Southern Bell Telephone & Telegraph Co. estimates its loss in Tennessee roughly at $250,000. They report some 4,100 poles down, many of them small. The Tennessee Electric Power Co. also suffered severe losses, as did the telegraph companies and the local telephone companies. It is believed that the total losses from the ice storm, exclusive of trees, will approximate $350,000, and the removal of broken trees and other debris from the streets and highways was a big task.

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SOLAR OBSERVATIONS

SOLAR RADIATION MEASUREMENTS DURING MARCH, 1934

By Irving F. Hand, Assistant in Solar Radiation Investigations

For a description of instruments employed and their exposures, the reader is referred to the January 1932 Review, page 26.

Table 1 shows that solar radiation values were close to normal at all three Weather Bureau stations.

Table 2 shows a deficiency in the total solar radiation received on a horizontal surface at Washington, Madison, Pittsburgh, Fairbanks, and Miami, and an excess at all other stations.

Polarization observations obtained at Washington on 5 days give a mean of 61 percent with a maximum of 65 percent on the 15th. Both of these values are close to the March normals. At Madison observations were taken on the 27th only and the value then obtained, 60 percent, is below the mean for March.

TABLE 1.—*Solar radiation intensities during March 1934*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D.C.

Date	Sun's zenith distance: 8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass: A.M.					P.M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	1.0[1]	2.0	3.0	4.0	5.0	e.
	mm	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm
Mar. 1	2.06	0.71	0.79	0.90	1.20	1.44					2.26
Mar. 9	2.06		.68	.89	1.12	1.48					2.16
Mar. 12	1.78	.62	.78	.93	1.12	1.55	1.13	0.94			1.52
Mar. 13	2.74	.68	.85	1.03	1.22	1.53	1.14				3.45
Mar. 15	1.78	.92	1.07	1.19	1.38	1.63	1.33	1.18			1.68
Mar. 19	2.16						1.24				1.96
Mar. 29	3.45	.68	.87	1.06	1.21	1.54					2.49
Mar. 30	4.37				1.20						3.45
Means		.72	.84	1.00	1.21	1.53	1.21	(1.06)			
Departures		−.01	+.03	+.05	+.05		+.08	+.12			

Madison, Wis.

Date	75th mer. time	5.0	4.0	3.0	2.0	1.0[1]	2.0	3.0	4.0	5.0	Local mean solar time
Mar. 7	2.16		1.17	1.32	1.47	1.60	1.25				2.16
Mar. 10	.86			1.21							.86
Mar. 14	1.52		1.17	1.30		1.57					2.16
Mar. 15	2.62				.84						2.62
Mar. 16	2.87	0.94	1.04	1.21							2.87
Mar. 19	2.77	.66	.83			1.56	1.29				2.77
Mar. 21	3.63	.91	1.03	1.17	1.31						3.63
Mar. 24	1.19		.84			1.57					1.19
Mar. 27	1.52		1.09	1.22	1.37	1.59	1.07				1.52
Means		.84	1.02	1.24	1.27		1.20				
Departures		−.11	−.02	+.07	−.05		−.10				

TABLE 1.—*Solar radiation intensities during March 1934*—Contd.

Lincoln, Nebr.

Date	Sun's zenith distance: 8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass: A.M.					P.M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	1.0[1]	2.0	3.0	4.0	5.0	e.
	mm	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm
Mar. 2	3.81		0.87	1.01	1.35	1.53	1.35	1.22	1.12	0.94	4.95
Mar. 6	2.36				.99						1.88
Mar. 8	1.78		.82	.94	1.28						3.15
Mar. 12	4.57						1.34	1.16	1.04	.90	4.75
Mar. 19	2.62		.90	1.07	1.26	1.46		1.04	.91	.81	4.95
Mar. 21	4.37		.81	.94	1.14	1.50	1.25	1.16	1.00	.89	3.81
Mar. 24	1.37					1.58					1.68
Mar. 25	1.96	0.76	.89	1.08	1.28						3.00
Mar. 27	2.16	.74	.89	1.17	1.38	1.54					1.88
Means		(.75)	.86	1.04	1.24	1.52	1.31	1.14	1.02	.88	
Departures		−.08	−.06	+.01	−.03		+.03	+.05	+.08	+.06	

Blue Hill, Mass.

Date	75th mer. time	5.0	4.0	3.0	2.0	1.0[1]	2.0	3.0	4.0	5.0	Local mean solar time
Mar. 1	1.2				1.33	1.46	1.12	0.72			1.0
Mar. 5	7.3					1.36	1.18	1.02			6.6
Mar. 6	4.0					1.56	1.21	.94			1.5
Mar. 12	1.4				1.35	1.56	1.35	1.19	0.89		1.2
Mar. 14	4.6				.98	.99					3.7
Mar. 16	3.4					1.49	1.01				2.8
Mar. 17	3.4				1.12						3.8
Mar. 18	6.5				.76	1.27					6.9
Mar. 21	2.0				1.27	1.43					1.8
Mar. 25	2.9				1.12	1.45	1.15	.97	.91		2.0
Mar. 26	3.7				1.08	1.33					2.1
Mar. 29	3.9				1.13	1.42	1.22	.95	.76		2.6
Means					1.13	1.39	1.18	.96	.85		

[1] Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Pittsburgh	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	Mount Washington
	Gram calories per square centimeter														
1934	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
Feb. 26	274	254	388	207	226	370	116	106	237	372	291	248	402	302	322
Mar. 5	261	356	369	257	229	463	177	146	429	286	371	342	451	302	[1] 229
Mar. 12	412	314	398	256	346	461	258	168	448	403	356	408	453	390	[1] 233
Mar. 19	249	392	383	400	342	456	204	186	449	363	512	403	397	442	[1] 365
Mar. 26	308	224	399	198	270	528	182	318	332	456	408	387	484	306	405
	Departures from weekly normals														
Feb. 26	−15	−26	+46	±0	−13	−10	−60	−29	−58	+36	−83	−28			
Mar. 5	−65	+54	+15	+51	−40	+73	−23	−13	+104	−47	−24	+38			
Mar. 12	+80	−2	+22	+45	+67	+51	+39	−18	+100	+55	−67	+88			
Mar. 19	−94	+71	−11	+163	+58	+4	−18	−35	+89	−12	−56	+80			
Mar. 26	−38	−128	−8	−23	+18	+42	−59	+43	−38	+42	−58	+47			
	Accumulated departures on April 2														
	−1,456	−903	−231	+2,359	+2,709	+565	−1,806	−280	+833	+2,219	−1,673	+2,926			

[1] Interpolated values. On March 8 pyrheliometer stem broke inside cover; new instrument installed March 30.

TABLE 3.—*Total, I_m and screened, I_y, I_r, solar radiation intensity measurements, obtained during March 1934, and determinations of the atmospheric turbidity factor, β and water-vapor content, w=depth in centimeters, if precipitated*

American University, Washington, D. C.

Date and hour angle	Solar altitude	Air mass	I_m	I_y	I_r	βI_{m-r}	βI_{y-r}	β_{mean}	$\frac{I_{w=0}}{1.94}$	$\frac{I_{w=0}-I_m}{1.94}$	w
									Percentage of solar constant		
Mar. 12	° ′	m	gr. cal.	gr. cal.	gr. cal.						cm
3:26 a.	26 35	2.23	1.075	0.795	0.678	0.103	0.139	0.121	58.9	2.6	0.1
3:20 a.	27 34	2.15	1.082	.796	.679	.103	.143	.123	59.4	3.6	.1
2:22 a.	36 38	1.67	1.207	.921	.750	.120	.082	.101	68.0	5.8	.2
2:17 a.	37 20	1.65	1.196	.924	.752	.176	.082	.129	64.3	2.7	.1
0:54 a.	45 57	1.39	1.342	.934	.759	.066	.102	.089	74.0	4.9	.2
0:48 a.	46 20	1.38	1.345	.939	.761	.068	.088	.078	75.1	5.8	.3
Mar. 13											
1:12 a.	44 56	1.41	1.333	.927	.717	.040	.028	.034	82.0	13.5	3.6
1:08 a.	45 15	1.41	1.338	.932	.720	.040	.026	.033	82.4	13.5	3.6
0:56 a.	46 10	1.39	1.344	.932	.727	.042	.038	.040	81.7	12.5	3.1
0:53 a.	46 22	1.38	1.344	.932	.727	.042	.040	.041	81.6	12.4	2.7
1:39 p.	42 15	1.49	1.300	.958	.765	.087	.059	.073	75.5	8.5	.5
1:43 p.	41 37	1.50	1.300	.959	.763	.085	.053	.069	76.3	9.3	.5
1:48 p.	41 16	1.52	1.321	.953	.763	.065	.061	.063	76.8	8.7	.5
3:46 p.	23 20	2.52	1.044	.771	.630	.068	.078	.073	65.2	11.4	1.4
3:50 p.	22 37	2.59	1.012	.767	.627	.074	.076	.075	62.9	10.1	1.0
Mar. 29											
0:40 a.	53 16	1.25	1.520	1.070	.860	.035	.039	.037	82.8	4.5	.2
0:36 a.	53 29	1.24	1.492	1.070	.858	.058	.042	.050	81.6	4.7	.3

Sky conditions at time radiation measurements were made. International meteorological symbols have been employed to designate clouds, wind, and optical phenomena, hz for haze, v for visibility, 0 for solar corona.

Mar. 12. Temp., −6 C.; wind, S. 8; v., 12; stopped by clouds in afternoon.

Mar. 13.—Temp., 4 C.; wind, SW. 10; v., 20; stopped by clouds late afternoon.

Mar. 29.—Temp., 5 C.; wind, N. 8; v. 30–50; blast furnace smoke at times; clouds late afternoon.

Blue Hill Meteorological Observatory of Harvard University

Date and hour angle from apparent noon 1934	Solar altitude	Air mass	I_m	I_y	I_r	βI_{m-r}	βI_{y-r}	β_{mean}	$\frac{I_{w=0}}{1.94}$	$\frac{I_{w=0}-I_m}{1.94}$	w
									Percentage of solar constant		
Mar. 1	° ′		gr. cal.	gr. cal.	gr. cal.						mm
0:05 a.	40 08	1.55	1.331	0.944	0.760	0.039	0.075	0.057	77.2	9.8	7.0
2:14 p.	31 30	1.91	1.189	.878	.689	.070	.045	.058	73.3	13.1	27.0
3:19 p.	22 45	2.58	1.114	.817	.656	.051	.048	.050	68.8	12.4	17.0
Mar. 2											
0:13 a.	40 26	1.54	1.180	.802	.637	.072	.104	.088	72.1	12.4	24.0
Mar. 5											
0:28 p.	41 15	1.52	1.306	.913	.713	.052	.028	.040	80.9	14.7	40.0
0:37 p.	40 57	1.53	1.272	.887	.689	.053	.045	.049	78.9	14.4	46.0
Mar. 12											
2:13 a.	35 20	1.73	1.447	1.005	.788	.011	.010	.010	84.8	11.1	14.0
1:05 a.	42 05	1.49	1.437	1.012	.797	.033	.027	.030	82.8	9.6	5.6
0:28 p.	45 57	1.39	1.451	1.021	.795	.032	.006	.019	84.7	10.8	15.0
1:54 p.	42 46	1.47	1.423	.996	.795	.041	.029	.035	82.2	9.7	8.3
3:36 p.	23 41	2.48	1.252	.883	.728	.057	.066	.062	67.0	3.2	1.9
Mar. 14											
2:12 a.	36 10	1.69	.978	.702	.562	.132	.144	.138	62.9	13.1	29.0
1:09 a.	43 03	1.46	1.011	.727	.580	.153	.155	.154	64.5	13.0	32.0
0:21 p.	44 56	1.41	1.012	.719	.577	.160	.173	.166	63.7	12.1	24.0
Mar. 16											
1:23 a.	42 09	1.49	1.239	.854	.670	.094	.073	.084	70.2	7.0	3.0

TABLE 3.—*Total, I_m and screened, I_y, I_r, solar radiation intensity measurements, obtained during March 1934, and determinations of the atmospheric turbidity factor, β and water-vapor content, w=depth in centimeters, if precipitated*—Continued

Blue Hill Meteorological Observatory of Harvard University—Continued

Date and hour angle from apparent noon 1934	Solar altitude	Air mass	I_m	I_y	I_r	βI_{m-r}	βI_{y-r}	β_{mean}	$\frac{I_{w=0}}{1.94}$	$\frac{I_{w=0}-I_m}{1.94}$	w
									Percentage of solar constant		
Mar. 17	° ′		gr. cal.	gr. cal.	gr. cal.						cm
2:42 a.	33 15	1.82	1.179	0.833	0.674	0.071	0.098	0.084	69.4	9.2	5.5
1:42 a.	40 41	1.53	1.236	.861	.671	.055	.042	.048	79.1	16.0	-----
0:42 a.	45 21	1.40	1.205	.859	.662	.086	.048	.067	77.3	15.8	-----
0:18 p.	46 10	1.39	1.151	.805	.622	.089	.063	.076	75.9	17.2	-----
Mar. 18											
2:02 a.	38 45	1.60	.948	.692	.552	.158	.188	.173	59.2	10.8	13.0
Mar. 21											
2:41 a.	34 30	1.76	1.294	.914	.734	.043	.047	.045	77.5	11.3	15.0
1:44 a.	41 53	1.49	1.298	.914	.730	.074	.073	.074	75.1	8.7	5.0
1:14 a.	44 56	1.41	1.319	.917	.739	.067	.088	.078	76.4	8.9	5.2
0:51 p.	46 25	1.38	1.284	.903	.715	.075	.071	.073	76.3	7.6	4.8
Mar. 23											
0:59 a.	46 36	1.38	1.421	1.014	.805	.052	.032	.042	82.2	9.4	7.7
Mar. 25											
1:10 a.	46 36	1.38	1.335	.954	.775	.062	.081	.072	73.3	4.8	1.6
0:28 p.	49 02	1.32	1.384	.954	.775	.062	.061	.062	79.0	8.0	4.4
2:54 p.	33 52	1.79	1.209	.876	.705	.071	.074	.072	72.0	10.0	8.6
4:35 p.	16 48	3.45	.924	.729	.598	.075	.062	.068	58.1	10.7	6.3
Mar. 26											
0:47 a.	48 31	1.33	1.186	.830	.671	.116	.108	.112	72.0	11.6	21.0
0:37 p.	49 04	1.32	1.174	.804	.641	.099	.070	.084	72.1	11.9	24.4
Mar. 29											
0:55 p.	49 11	1.32	1.276	.901	.702	.078	.053	.066	78.5	12.9	34.4

Atmospheric Conditions During Solar Radiation Measurements

Date and time from apparent noon	Wind	Visibility	Sky blueness	Clouds	Remarks
March 1934					
1, 0:05 a.	SSW 4	-----	3	3 Ci, Cist	Dns. hz. in all dir.
2, 0:13 a.					Sky clear only ½ hr.
5, 0:28 p.	WNW 4	-----	4	Clear to 3 p.m.	Cicu. formed rapidly. Covered sun at 2:56 p.m.
12, 2:13 a.	WNW 5	-----	3	0 clouds	
1:05 a.	WNW 3	-----	3	0 clouds	
0:28 p.	W 3	-----	3	Few Cu	
3:35 p.	W 3	-----	4	Trace, Cicu, Frcu.	
14, 2:12 a.	SSW 3	-----	2	0 clouds	Hz. in all directions.
0:21 p.	WNW 4	-----	2	0 clouds	Do.
16, 1:23 a.	SSW 4	-----	3	3 Ci, Cist	Thin film Ci over sun.
17, 2:42 a.	WSW 1–2	-----	3	0 clouds	Lt. Hz.
0:18 p.	SSW 2	-----	3	0 clouds	
18, 2:02 a.	S 6	-----	2	0 clouds	Hz. in all directions.
21, 2:41 a.	ENE 1	-----	3	0 clouds	Heavy haze.
0:51 p.	SSE 2	7	3	Few Ci, Cicu	Thin Ci film over sun.
23, 0:59 a.					
25, 1:10 a.	WNW 3	-----	3	0 clouds	Moderate Hz.
0:28 p.	WNW 3	7	3	Few Cu, Frcu	Possibly thin cld. film over sun.
2:54 p.	WNW 2	7–8	2	Few Frcu	Moderate Hz.
26, 0:47 a.	SSE 3	-----	3	Few Ci	Ci. low and indefinite in form.
0:37 p.	S 5	-----	3	Few Ci, Ast	Thickening Ci. fibers over sun.
29, 0:55 p.	NW&N 2	7	4	0 clouds	Hz. in all directions.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U.S. Navy, Superintendent U.S. Naval Observatory. Data furnished by the U.S. Naval Observatory in cooperation with Harvard and Mount Wilson Observatories. Difference in longitude is measured from the central meridian, positive west. North latitude is positive. Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area for each day includes spots and groups]

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
1934	h. m.	°	°	°				
Mar. 1	11 0	No spots						U.S. Naval.
Mar. 2	11 15	No spots						Mt. Wilson.
Mar. 3	11 20	No spots						U.S. Naval.
Mar. 4	11 45	−12.0	180.4	+0.5	3		3	Mt. Wilson.
Mar. 5	11 34	No spots						U.S. Naval.
Mar. 6	11 18	No spots						Do.
Mar. 7	12 50	−64.0	88.4	−27.0	2			Mt. Wilson.
		−26.0	126.4	−3.0		21	23	
Mar. 8	13 10	−54.0	84.9	−28.0		4		Do.
		−11.0	127.9	−3.0		37	41	
Mar. 9	11 18	−40.0	86.8	−27.5		9		U.S. Naval.
		+2.0	128.8	−3.0		31	40	
Mar. 11	12 28	No spots						Do.
Mar. 12	11 16	No spots						Do.
Mar. 13	11 22	No spots						Do.
Mar. 14	11 0	No spots						Mt. Wilson.
Mar. 15	11 6	No spots						U.S. Naval.
Mar. 16	13 17	No spots						Do.
Mar. 17	11 10	No spots						Do.
Mar. 18	10 50	No spots						Do.
Mar. 19	11 54	No spots						Mt. Wilson.
Mar. 20	11 33	No spots						U.S. Naval.
Mar. 21	11 20	No spots						Do.
Mar. 22	10 58	No spots						Mt. Wilson.
Mar. 24	10 56	No spots						Do.
Mar. 25	12 9	No spots						U.S. Naval.
Mar. 26	10 30	+3.0	266.1	−28.0	6		6	Mt. Wilson.
Mar. 27	9 45	No spots						Do.
Mar. 28	11 35	No spots						Do.
Mar. 29	11 10	No spots						U.S. Naval.
Mar. 30	11 8	No spots						Do.
Mar. 31	11 0	No spots						Mt. Wilson.
Mean daily area for March.							4	

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR MARCH 1934

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, Eidgenössische Sternwarte, Zurich, Switzerland]

March 1934	Relative numbers	March 1934	Relative numbers	March 1934	Relative numbers
1		11	15	21	0
2	0	12	7	22	0
3	0	13	0	23	0
4	7	14	0	24	0
5	0	15	0	25	7
6	*Ec* 7	16	0	26	7
7	9	17	0	27	0
8	19	18	7	28	0
9	*a* 22	19	0	29	7
10	12	20	0	30	7
				31	0

Mean: 30 days—4.4.

a=Passage of an average-sized group through the central meridian.
c=New formation of a center of activity: *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central zone.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. Little, in charge]

By L. T. Samuels

Free-air temperatures during March averaged below normal at all levels at Omaha and Pembina; at the upper levels at Pensacola and San Diego; and lower levels at Cleveland and Washington (table 1). Elsewhere the temperature departures were positive. Relative humidity departures for the month were mostly negative, the largest positive departures occurring at Pensacola.

Free-air resultant wind directions were practically normal over the entire country with some excess of southerly components along the middle Pacific coast (table 2). Resultant velocities were mostly below normal over the southern half of the country and above normal over the northern half.

TABLE 1.—*Free-air temperatures and relative humidities obtained by airplanes during March 1934*

TEMPERATURE (°C.)

Altitude (meters) m.s.l.	Boston, Mass.[1] (6 meters) Mean	Boston Departure from normal	Cleveland, Ohio[2] (246 meters) Mean	Cleveland Departure from normal	Dallas, Tex.[3] (146 meters) Mean	Dallas Departure from normal	Omaha, Nebr.[4] (300 meters) Mean	Omaha Departure from normal	Pembina, N. Dak.[5] (243 meters) Mean	Pembina Departure from normal	Pensacola, Fla.[6] (2 meters) Mean	Pensacola Departure from normal	San Diego, Calif.[6] (5 meters) Mean	San Diego Departure from normal	Washington, D.C.[6] (2 meters) Mean	Washington Departure from normal
Surface	1.1	(7)	−2.8	(7)	8.3	(7)	−2.0	(7)	−10.4	(7)	11.9	+0.3	17.3	+1.8	0.8	−4.3
500	−1.7	(7)	−1.7	(7)	9.3	(7)	−1.3	(7)	−9.8	(7)	12.1	+1.4	15.4	+1.5	.6	−2.7
1,000	−3.3	+1.4	−2.2	−1.2	9.8	+1.1	−.7	−1.6	−10.6	−3.5	10.8	+1.9	17.3	+3.9	−.1	−1.5
1,500	−4.5	+2.1	−2.5	−.1	9.5	+2.2	−.9	−1.2	−11.3	−3.0						
2,000	−5.7	+2.0	−3.8	+.2	7.6	+1.9	−2.1	−.7	−12.0	−1.8	6.4	+1.2	12.6	+3.8	−4.0	−1.1
2,500	−7.3	+1.8	−5.6	+.6	5.0	+1.6	−4.4	−.5	−14.0	−1.5						
3,000	−8.4	+3.3	−7.8	+.9	2.0	+1.1	−6.9	−.4	−16.7	−1.4	.9	.0	6.4	+3.3	−6.5	+.3
4,000	−13.2		−12.9	+.9	−5.3	−.5	−13.0	−1.2	−21.7	−1.1	−5.9	−.7	−1.7	+3.3		
5,000	−18.4		−18.5	+1.5	−13.4	−2.8	−19.5	−1.1	−27.9	−1.5	−12.9	−1.2				

RELATIVE HUMIDITY (PERCENT)

Altitude (meters) m.s.l.	Boston Mean	Boston Departure from normal	Cleveland Mean	Cleveland Departure from normal	Dallas Mean	Dallas Departure from normal	Omaha Mean	Omaha Departure from normal	Pembina Mean	Pembina Departure from normal	Pensacola Mean	Pensacola Departure from normal	San Diego Mean	San Diego Departure from normal	Washington Mean	Washington Departure from normal
Surface	70	(7)	76	(7)	81	(7)	75	(7)	87	(7)	82	+8	74	+6	67	+1
500	71	(7)	71	(7)	71	(7)	70	(7)	75	(7)	74	+8	72	+6	61	−2
1,000	68	−4	65	−1	60	0	59	−2	67	+2	69	+9	45	−7	56	−4
1,500	62	−8	57	−2	53	+2	55	+3	63	+4						
2,000	59	−9	52	−3	46	+3	54	+4	56	−1	62	+10	30	−7	48	−7
2,500	57	−13	50	−3	42	+3	54	+4	53	−4						
3,000	51	−21	53	0	38	+1	53	+2	53	−5	57	+10	23	−7	56	+8
4,000	51		57	+7	37	−2	54	+4	52	−4	54	+11	20	−7		
5,000	52		57	+3	36	−3	56	+6	52	−3	48	+4				

Times of observations: Weather Bureau, 5 a.m.; Navy, 7 a.m.; and Massachusetts Institute of Technology, 8 a.m. (eastern standard time).

[1] Airplane observations made by Massachusetts Institute of Technology; departures based on normals obtained from 264 kite observations made at Blue Hill Meteorological Observatory (1896–1903).

[2] Temperature departures based on normals determined by extrapolating latitudinally those of Royal Center, Ind., and Due West, S.C. Humidity departures based on normals of Royal Center, Ind.

[3] Temperature departures based on normals determined by interpolating latitudinally those of Groesbeck, Tex., and Broken Arrow, Okla. Humidity departures based on normals of Groesbeck, Tex.

[4] Temperature and humidity departures based on normals of Drexel, Nebr.

[5] Temperature departures based on nomrals determined by extrapolating latitudinally those of Ellendale, N.Dak., and Drexel, Nebr. Humidity departures based on normals of Ellendale, N.Dak.

[6] Naval air stations.

[7] Surface and 500 meter level departures omitted because of difference in time of day between airplane observations and those of kites upon which the normals are based.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a.m. (eastern standard time) during March 1934*

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m.s.l.	Albuquerque, N.Mex. (1,554 meters) Direction	Albuquerque Velocity	Atlanta, Ga. (309 meters) Direction	Atlanta Velocity	Bismarck, N.Dak. (518 meters) Direction	Bismarck Velocity	Brownsville, Tex. (7 meters) Direction	Brownsville Velocity	Burlington, Vt. (132 meters) Direction	Burlington Velocity	Cheyenne, Wyo. (1,873 meters) Direction	Cheyenne Velocity	Chicago, Ill. (192 meters) Direction	Chicago Velocity	Cleveland, Ohio (245 meters) Direction	Cleveland Velocity	Dallas, Tex. (154 meters) Direction	Dallas Velocity	Havre, Mont. (762 meters) Direction	Havre Velocity	Jacksonville, Fla. (14 meters) Direction	Jacksonville Velocity	Key West, Fla. (11 meters) Direction	Key West Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	347	1.1	312	1.7	343	0.8	192	0.4	200	1.5	274	5.3	282	1.5	171	1.2	173	0.3	244	1.7	295	0.3	57	2.7
500			281	2.4			162	5.4	226	3.5			258	3.1	318	3.5	236	3.3			190	2.5	78	5.1
1,000			313	3.2	295	5.4	186	4.7	253	6.0			272	4.4	260	5.2	240	4.0	266	4.4	206	3.1	104	3.6
1,500			293	4.0	295	8.5	201	3.7	263	7.9			280	7.6	259	6.3	263	4.3	299	9.4	234	4.2	128	1.3
2,000	304	1.6	298	4.6	300	11.7	238	2.0	271	9.7	273	8.4	280	9.2	265	9.1	285	6.2	302	10.9	255	5.0	215	0.7
2,500	314	4.9	288	6.5	313	15.2	301	1.7	274	12.6	296	15.3	270	12.5	268	10.8	314	6.6	300	11.1	269	5.8	187	1.0
3,000	310	7.4	288	8.8	316	15.1	337	3.4	283	13.1	303	13.8	300	14.3	272	10.5	315	8.1	295	14.6	286	6.8	258	2.5
4,000	307	9.0	289	10.2			326	5.0			301	13.9					310	6.9	296	17.1				
5,000	324	10.7																						

Altitude (meters) m.s.l.	Los Angeles, Calif. (217 meters) Direction	Los Angeles Velocity	Medford, Oreg. (410 meters) Direction	Medford Velocity	Memphis, Tenn. (83 meters) Direction	Memphis Velocity	New Orleans, La. (1 meter) Direction	New Orleans Velocity	Oakland, Calif. (8 meters) Direction	Oakland Velocity	Oklahoma City, Okla. (402 meters) Direction	Oklahoma City Velocity	Omaha, Nebr. (306 meters) Direction	Omaha Velocity	Phoenix, Ariz. (338 meters) Direction	Phoenix Velocity	Salt Lake City, Utah (1,294 meters) Direction	Salt Lake City Velocity	Sault Ste. Marie, Mich. (198 meters) Direction	Sault Ste. Marie Velocity	Seattle, Wash. (14 meters) Direction	Seattle Velocity	Washington, D.C. (10 meters) Direction	Washington Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	357	1.1	238	0.1	5	0.9	60	1.6	54	0.6	33	1.1	20	0.7	86	2.0	148	2.1	325	0.6	182	0.9	351	1.3
500	20	0.9	304	0.3	240	5.4	140	2.5	323	1.1	151	0.7	269	1.4	91	2.5			312	1.0	208	1.9	303	1.8
1,000	25	1.4	198	0.9	243	6.3	225	1.9	330	1.7	238	3.4	305	4.9	333	1.6			297	3.7	198	3.7	297	4.2
1,500	357	1.2	195	2.2	252	5.6	262	2.8	76	0.3	285	4.5	305	6.6	317	2.8	160	2.1	296	6.7	230	3.8	297	7.4
2,000	339	1.0	205	3.4	256	8.0	301	5.2	307	0.6	298	6.2	299	9.2	326	3.0	278	2.0	307	8.3	251	5.2	279	10.1
2,500	305	1.2	231	3.5	270	8.3	302	6.6	193	1.6	305	7.6	302	10.9	323	2.7	294	4.8	305	9.2	257	6.7	279	13.2
3,000	292	2.3	243	4.4	292	7.3	282	7.7	244	1.8	304	9.6	306	13.8	305	2.2	301	6.9	293	8.6	266	5.5	273	15.9
4,000	289	3.3	257	7.5					227	4.2	297	10.3	311	13.6	310	4.4	311	8.8			278	6.8		
5,000															294	7.4	306	10.7						

RIVERS AND FLOODS

By Richmond T. Zoch

(River and Flood Division, Montrose W. Hayes, in charge)

Ice was very thick at the beginning of March in the rivers of the North Atlantic Slope following an unusually cold February. When the weather became warm early in March considerable apprehension was felt along the rivers that ice gorges would do much damage. However, the ice moved out without causing more than slight damage in any river; in fact, in many rivers of this section flood stage was not reached.

Ice gorges were reported in the Missouri River and while the flood stage was not reached at any of the Weather Bureau's river gages, flooding and moderate damage was caused by a gorge at Oak Mills, Kans.

Considerable apprehension was felt along the Ohio, especially at Pittsburgh. In this connection the following reports of officials on the conditions in the Ohio River during February and March are of interest:

Pittsburgh, Pa.—On March 1 the district was covered with newly fallen snow from 6 to 10 inches deep, and the rivers above Pittsburgh were covered with thick ice. On the 2d the temperature rose to considerably above freezing and rain set in during the afternoon. The ice in the rivers began breaking up on the 3d, forming gorges in various sections of the rivers, and consequently back water above the gorges. The rise in the upper Monongahela River reached flood stages as a result of heavy run-off, but in the Allegheny the flood stages were due to a huge gorge that formed at the head of slack water.

The only damage due to flooding occurred at Parkers Landing and as far down as Mosgrove, Allegheny River, and did not exceed $4,000 for suspension of business and damage to property. The remainder of the damage reported ($126,600) was caused by ice.

At East Brady, Allegheny River, between Parkers Landing and Dam No. 8, the gorged ice lifted the steel Highway Bridge off the piers, and carried two spans about 19 miles down the river and over Dam No. 8, where they sank.

In the Monongahela River several fleets of loaded coal barges were tied along the shores during the early part of the winter, and were frozen in during February. When the ice started out the mooring lines snapped and the loaded barges started down the river with the ice. Many of the barges were caught later, and saved, but eight of them went over Dams Nos. 4 and 3 and were wrecked.

Cincinnati, Ohio.—Floating ice made its appearance in the Cincinnati district on February 3, and ice of varying amounts and thickness was observed in the river during the remainder of the month. Practically all of the dams in the district were lowered on the 9th on account of the menacing ice conditions. This resulted in abnormally low river stages which became so low by the middle of the month that the raising of the dams again became necessary. By the 25th, however, heavy ice again forced the lowering of the dams. The ice and low water caused an interruption and at times complete cessation of navigation.

The mean daily river stage at Cincinnati for February 1934, 11.7 feet, was the lowest mean daily stage recorded during any February since the beginning of official records.

During the month of March flood stages were not reached at any station along the Ohio, but crest stages were within a few feet of the flood line at several places between the 7th and 9th.

Cairo, Ill.—Rivers in this district were comparatively low throughout the month of February. Dams 50 and 51 were down on the 2d and 3d, but not much rise occurred. All Ohio River dams were lowered on the night of the 26th–27th, mostly on account of an expected run of floating ice, and they continued down at the close of the month, with a slow rise in progress.

The mean stage at Cairo was 10.1 feet, very low for February, the normal stage being 29.2 feet. The minimum stage of 7 feet at Cairo on the 19th was the lowest for the month of February since the year 1895.

Although flood stages were reached in the Ohio at most points below Dam No. 47 only very slight damage was caused.

In addition to the local inundations caused by ice gorges there were numerous floods in the eastern half of the country, but all were of minor importance, except one in the Sabine River, which will be commented on in a later issue of the Monthly Weather Review.

Table of flood stages during March 1934

[All dates in March unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE	Feet			Feet	
Hoosic: Hoosick Falls, N.Y	4	5	6	5.0	5
Hudson:					
Troy, N.Y	15	6	6	18.3	6
Albany, N.Y	12	6	6	15.8	6
Delaware: Trenton, N.J	12	4	6	14.2	5
Chenango: Sherburne, N.Y	8	4	6	9.2	5
		27	28	9.6	27
Susquehanna:					
Oneonta, N.Y	12	5	7	16.2	5
Bainbridge, N.Y	11	4	6	13.8	5
Binghamton, N.Y	14	5	6	17.7	5
James:					
Columbia, Va	10	4	11	19.9	5
		28	Apr. 1	19.0	29
Richmond, Va	8	6	7	9.8	6
Dan: Danville, Va	8	4	4	8.0	4
Roanoke:					
Randolph, Va	18	5	6	22.8	5
		29	29	21.1	29
Weldon, N.C	31	5	8	38.8	7
		29	31	35.7	31
Williamston, N. C	10	11	17	11.3	13
		29	Apr. 9	11.4	Apr. 5, 6
Neuse:					
Neuse, N.C	13	30	30	13.9	30
Smithfield, N.C	12	29	31	12.8	31
Saluda:					
Pelzer, S.C	7	4	6	10.3	5
Chappells, S. C	12	Feb. 28	Feb. 28	12.1	Feb. 28
		5	8	15.5	7
		29	29	12.2	29
Broad: Blairs, S.C	14	5	6	17.4	5
		29	29	17.0	29
Santee:					
Rimini, S.C	12	1	12	16.1	10
Ferguson, S. C	12	8	13	13.1	11, 12
Savannah:					
Ellenton, S.C	14	Feb. 28	3	17.2	2
		5	13	21.9	8
		29	Apr. 3	17.1	31
Clyo, Ga	13	9	21	17.1	13
Ogeechee:					
Midville, Ga	6	10	10	6.0	10
Dover, Ga	7	13	18	7.8	15
Ocmulgee: Abbeville, Ga	11	10	15	12.9	12
Oconee: Milledgeville, Ga	22	5	5	26.0	5
Altamaha:					
Charlotte, Ga	12	11	19	15.5	14
Everett City, Ga	10	17	23	10.8	18, 19
EAST GULF OF MEXICO DRAINAGE					
Chattahoochee: Alaga, Ala	30	6	7	33.5	7
Apalachicola: Blountstown, Fla	15	6	15	20.0	9, 10
Choctawhatchee: Caryville, Fla	12	8	9	12.2	8
Oostanaula:					
Resaca, Ga	22	5	7	27.3	6
Rome, Ga	25	5	6	27.9	5
Etowah: Canton, Ga	17	4	5	19.5	4
Coosa:					
Mayos Bar Lock, Ga	28	5	7	31.6	6
Gadsden, Ala	20	5	11	23.3	6
Lock No. 4, Lincoln, Ala	17	4	7	19.5	4
Cahaba: Centerville, Ala	23	Feb. 26	Feb. 26	27.5	Feb. 26
		3	5	32.0	3
Alabama:					
Montgomery, Ala	30	5	9	37.5	6
Selma, Ala	35	6	10	41.4	8
Millers Ferry, Ala	40	7	12	45.0	9
Black Warroir: Lock No. 10, Tuscaloosa, Ala	46	3	7	57.6	4
Tombigbee:					
Aberdeen, Miss	34	5	5	34.0	5
Lock No. 4, Demopolis, Ala	39	4	17	53.9	12
Lock No. 3, Ala	33	Feb. 28	19	54.7	13
		29	Apr. 3	38.0	Apr. 1
Lock No. 2, Ala	46	4	18	55.5	14
Lock No. 1, Ala	31	4	21	37.6	16, 17
Chickasawhay: Enterprise, Miss	20	5	6	21.3	5
Pascagoula: Merrill, Miss	18	6	11	18.8	8, 9
Pearl:					
Edinburgh, Miss	20	5	10	23.4	7
Jackson, Miss	18	3	19	28.0	12, 13
Monticello, Miss	15	4	8	18.8	4
Columbia, Miss	17	5	9	19.0	6, 7
Bogue Chitto: Franklinton, La	10	4	6	11.5	5
West Pearl: Pearl River, La	12	4	27	15.2	9

Table of flood stages during March 1934—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM					
Ohio Basin					
Allegheny:	*Feet*			*Feet*	
Parkers Landing, Pa	18	5	5	24.4	5
Lock No. 5, Schenley, Pa	24	6	6	28.0	6
Lock No. 4, Natrona, Pa	24	6	6	25.9	6
Monongahela:					
Lock No. 15, Hoult, W.Va	22	3	3	22.0	3
Lock No. 7, Greensboro, Pa	30	4	4	30.3	4
Guyandot: Logan, W.Va	20	3	3	20.8	3
Levisa Fork: Pikeville, Ky	35	3	3	35.0	3
North Fork: Jackson, Ky	24	3	5	35.5	4
Barren: Bowling Green, Ky	20	Feb. 27	Feb. 28	22.5	Feb. 27
		4	6	23.3	5
Green:					
Lock No. 6, Brownsville, Ky	28	4	8	32.1	6
Lock No. 4, Woodbury, Ky	33	Feb. 28	12	40.2	7
Lock No. 2, Rumsey, Ky	34	5	16	37.8	13
West Fork:					
Anderson, Ind	8	27	29	9.6	28
Edwardsport, Ind	12	29	Apr. 1	14.4	30
New: New River, Tenn	18	3	3	20.8	3
Cumberland:					
Williamsburg, Ky	19	4	4	21.8	4
Burnside, Ky	50	4	4	51.4	4
Celina, Tenn	28	Feb. 27	12	42.3	6
		21	30	37.2	27
Carthage, Tenn	40	4	7	44.1	6
		27	28	41.7	27
Nashville, Tenn	40	4	11	43.7	9
		26	31	42.3	29
Clarksville, Tenn	46	5	13	49.2	10
		29	Apr. 1	46.8	31
Lock F, Eddyville, Ky	50	6	17	57.1	13, 14
		28	Apr. 4	54.0	Apr. 3
North Fork: Mendota, Va	8	3	4	10.0	3
Pigeon: Newport, Tenn	6	3	5	9.5	4
French Broad:					
Ashville, N.C	4	3	5	5.0	3
Dandridge, Tenn	12	4	4	12.4	4
Little Tennessee: McGhee, Tenn	18	4	4	21.1	4
Clinch: Clinton, Tenn	25	5	5	25.3	5
		26	26	26.0	26
Hiwassee: Charleston, Tenn	22	4	4	22.4	4
Elk: Fayettville, Tenn	14	2	6	24.8	3
		24	28	22.3	24
Duck: Columbia, Tenn	30	25	27	35.1	26
Tennessee:					
Chattanooga, Tenn	30	5	7	34.1	6
Bridgeport, Ala	18	4	9	24.1	6
		26	29	20.0	28
Widows Bar Dam, Ala (lower gage)	26	4	9	33.3	6
		26	29	28.7	28
Guntersville, Ala	25	4	11	32.0	8
		27	31	28.1	29
Decatur, Ala	20	7	10	20.0	7–10
Florence, Ala	18	3	11	21.5	5
Riverton Lock, Ala	33	3	13	41.8	6
		27	Apr. 1	35.9	30

Table of flood stages during March 1934—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM—continued					
Ohio Basin—Continued					
Tennessee—Continued.	*Feet*			*Feet*	
Savannah, Tenn	39	6	12	40.8	8, 9
Johnsonville, Tenn	31	8	13	31.5	9–11
Ohio:					
Pittsburgh, Pa	25	6	6	25.8	6
Point Pleasant, W.Va	40	7	7	40.0	7
Dam No. 47, Newberg, Ind	35	9	16	38.2	13
Evansville, Ind	35	10	16	38.5	13, 14
Dam No. 48	35	12	15	36.7	14
Dam No. 50	32	10	18	36.3	15
Dam No. 52	35	10	18	39.0	15
Dam No. 53	38	11	18	41.4	15, 16
Cairo, Ill	40	13	17	41.2	16
White Basin					
Black: Black Rock, Ark	14	27	31	19.3	27
White:					
Georgetown, Ark	21	28	(1)	24.5	31
Clarendon, Ark	26	30	(1)	29.8	Apr. 7
Arkansas Basin					
Petit Jean: Danville, Ark	20	26	29	22.8	27
Red Basin					
Ouachita:					
Arkadelphia, Ark	12	27	28	19.3	27
Camden, Ark	26	5	8	28.2	6
		28	Apr. 4	33.3	31
Sulphur:					
Ringo Crossing, Tex	20	2	6	24.0	3
Naples, Tex	22	5	13	25.4	7
		29	Apr. 2	24.8	30
Lower Mississippi Basin					
Big Lake Outlet: Manila, Ark	10	27	(1)		
St. Francis: Fisk, Mo	20	29	30	20.8	29
Tallahatchie: Swan Lake, Miss	24	8	29	27.7	14–16
Atchafalaya Basin					
Atchafalaya: Atchafalaya, La	22	25	28	22.0	25–28
WEST GULF OF MEXICO DRAINAGE					
Sabine:					
Logansport, La	25	3	13	28.4	8
Bon Wier, Tex	21	29	31	21.4	30, 31
Trinity:					
Dallas, Tex	28	2	3	29.6	3
Liberty, Tex	25	4	12	27.5	7

[1] Flood continued into April.

WEATHER OF THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, Willis E. Hurd, temporarily in charge]

NORTH ATLANTIC OCEAN

By HERBERT C. HUNTER

Atmospheric pressure.—The mean pressure during March 1934 was above normal over most of the North Atlantic, particularly from the vicinity of the North American coast between the Gulf of St. Lawrence and Cape Hatteras eastward to the Iberian Peninsula. However, the northeastern portion of the ocean had average pressure lower than normal, with greatest deficiency around the British Isles and thence northwestward to Iceland.

The lowest reading at any of the selected shore stations was 28.47 inches on the 1st, at Reykjavik, Iceland. Readings a very little lower comparatively near to the southwestern tip of Ireland were reported as occurring during the morning of the 17th by three vessels, the lowest of them being 28.40 inches by the American steamship *Steel Age*, in latitude 50°15′ N., longitude 13°22′ W.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, March 1934*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.45		30.42	29	28.63	20
Reykjavik, Iceland	29.49	−0.19	30.11	31	28.47	1
Lerwick, Shetland Islands	29.56	−.14	30.21	25	28.72	17
Valencia, Ireland	29.68	−.22	30.40	27	28.64	17
Lisbon, Portugal	30.03	+.03	30.39	4	29.50	31
Madeira	30.12	+.11	30.40	16	29.74	31
Horta, Azores	30.34	+.16	30.58	22	29.91	31
Belle Isle, Newfoundland	29.93	+.13	30.46	25	29.26	7
Halifax, Nova Scotia	30.15	+.19	30.90	31	29.68	6, 7
Nantucket	30.14	+.16	30.75	1	29.58	5
Hatteras	30.16	+.12	30.64	1	29.46	20
Bermuda	30.20	+.06	30.48	1	29.64	21
Turks Island	30.05	+.03	30.18	1	29.96	15, 20
Key West	30.08	+.03	30.30	12	29.87	10
New Orleans	30.13	+.09	30.35	12	29.82	4
Cape Gracias, Nicaragua	29.95	+.02	30.00	7, 8	29.90	24, 25

NOTE.—All data based on a.m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—The reports at hand indicate that Atlantic gales were not so numerous as usual during March. This had been the case also during February, but the 2 months were in marked contrast as to the regions where intense winds were most frequently encountered; for the February gales occurred mainly between the forty-fifth meridian and the North American coast, while the March gales were met chiefly to eastward of the fortieth meridian. Substantially all the important gales of the North Atlantic during this month occurred within the 13-day period, 8th to 20th.

Strong gales were encountered on the 8th or 9th by many different vessels near the chief steamship lanes between the sixtieth and the fifteenth meridians. Two vessels on the 9th met gales of hurricane force to westward of mid-Atlantic waters; the German steamship *Berlin*, when about 200 miles south of Cape Race, and the Swedish motorship *Blankaholm*, when located at about one third of the way from Newfoundland to Ireland. (See chart VIII.)

Several centers of low pressure were connected with the gales of the 8th and 9th, but by the 11th a deep LOW was approaching the western coast of Ireland whence it advanced slowly eastward during the next 2 days (charts IX to XI.)

Pressure continued unusually low over the British Isles and two distinct LOWS from the region of Greenland traveled southeastward, the earlier about the 12th–14th, the later on the 15th and 16th, and coalesced with the chief LOW. Reports of whole gale force and storm force were numerous from the waters around the British Isles and to westward as far as midocean. Two more occurrences of hurricane force have come to hand, the first from the Norwegian motorship *Noreg*, which noted lowest pressure when in the English Channel on the 14th, but met greatest force of wind many miles to westward approximately 60 hours later. About the same time the British steamship *Minnie de Larrinaga* similarly recorded hurricane force, when 300 miles to southwestward of Ireland; this gale of the 17th was the final report of hurricane force in the Atlantic during March, though pressure continued decidedly low in the region of the British Isles until the 20th.

There was little storminess between the 21st and the 24th, but scattered occurrences during the final week of March may be noted. The most important was a gale of force 11 at a late hour of the 29th, at a location about midway between Newfoundland and France. Almost on the Tropic of Cancer two vessels noted easterly winds of force 8, one of them east of the Bahamas and north of Haiti, the other northeast of the Yucatan Channel.

Fog.—Normally there is an increase in the amount of fog as spring sets in over the North Atlantic. In March 1934 the increase was marked; fog was noted in most of the 5° squares on more days than the average for the month. There were, however, a few regions from which fog was apparently absent, though usually looked for; these were chiefly limited areas adjacent to Scotland and Ireland, a belt extending from the Iberian Peninsula to the waters around the Azores, and regions not far north and northwest of Bermuda.

In the Gulf of Mexico fog was less frequent than usual, as a rule; but the waters near Galveston Bay, Sabine Pass, and the southwestern coast of Louisiana had approximately the normal occurrence.

Near Chesapeake Bay fog was particularly frequent, being reported on 12 days, including all save 2 days after the 22d. The square which is indicated as next after this in prevalence is that between 40° and 45° north, and 45° and 50° west, where 11 days were noted as having fog. Here and in other squares of the Grand Banks area fog was encountered largely during three periods, centering about the 6th, 12th, and 22d, respectively.

From Cape Hatteras to the vicinity of Nova Scotia fog was notably dense about the 3d and 4th; marked delay to steamship service resulted, and 1 grounding and 2 collisions, none especially disastrous, were reported from the waters of New York Harbor. There was great delay of traffic in Long Island Sound, where ice combined with fog to hamper vessel movements. Another collision occurred in Delaware River and two in Chesapeake Bay, without serious havoc; but in the vicinity of Sable Island the British steamship *Concordia* sank on the afternoon of the 5th as the result of collision during heavy fog with the American steamer *Black Eagle*, no loss of life ensuing.

OCEAN GALES AND STORMS, MARCH 1934

Vessel	Voyage		Position at time of lowest barometer		Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Inches*					
Blankaholm, Swed. M.S.	Finland	Newport News.	58 13 N.	13 40 W.	Mar. 5	8a, Mar. 5	Mar. 5	29.02	WSW	WSW, 9	WNW	WSW, 9	WSW-W.
Sylvafield, Br. M.S	Newcastle	Philadelphia	58 16 N.	14 32 W.	Mar. 3	11a, 5	do	[2] 28.88	W	WNW, 8	NW	WNW, 10	WSW-NW.
Boston City, Br. S.S	England	Boston	45 10 N.	44 55 W.	Mar. 8	11p, 7	Mar. 8	29.55	WSW	W, 6	W	W, 9	W-WSW-W.
Blankaholm, Swed. M.S.	Finland	Newport News.	53 19 N.	34 30 W.	do	4p, 8	Mar. 9	29.00	N	N, 6	NW	NW, 9	None.
Sylvafield, Br.M.S	Newcastle	Philadelphia	53 38 N.	28 58 W.	do	Mdt. 8	do	[2] 28.62	W	NW, 8	NNW.	NW, 10	W-NW-NNW.
City of Omaha, Am.S.S.	Limhamn, Sweden.	Mobile	45 12 N	17 00 W.	Mar. 9	4a, 9	Mar. 12	29.66	SSW	SSW, 8	N	NW, 11	SSW-W.
Berlin, Ger. S.S	Cobh	Halifax	43.13 N.	53 05 W.	do	7a, 9	Mar. 9	[2] 29.49	SSW	SSW., 10	W	W., 12	
Blankaholm, Swed. M.S.	Finland	Newport News.	50 22 N.	39 45 W.	do	11p. 9	Mar. 11	29.02	S	SSW., 11	WNW.	SW., 12	S-W.
Paris, Fr. S.S	Havre	New York	47 30 N.	33 00 W.	Mar. 10	7a, 10	do	29.39	WSW	WSW, 10.	WNW.	WSW, 10.	None.
Skagerrak, Ger.M.S	Harburg	do	41 02 N.	66 14 W.	do	6a, 11	do	29.47	ENE	NNE, 9	N	ENE, 10	ENE-NNE-N.
Europa, Ger.S.S	English Channel	do	48 59 N.	15 00 W.	Mar. 11	4p. 11	Mar. 12	28.98	WNW.	WNW, 7	NW	NW, 11	None.
Leerdam, Du.S.S	New York	Rotterdam	48 20 N.	23 57 W.	Mar. 9	10p, 11	do	29.39	SW	WNW., 11	NW	WNW., 11	Do.
Grete, Ger.S.S	Savannah	Bremen	47 24 N.	27 00 W.	do	2a, 12	do	29.55	SSW	W., 11	NW	W., 11	W-NW.
City of Joliet, Am.S.S	Galveston	Havre	[1] 49 50 N.	[1] 1 20 W.	do	8a, 12	Mar. 10	28.84	WSW	SW., 3	W	W., 9	None.
Exochorda, Am.S.S	Malaga	Boston	36 02 N.	16 03 W.	Mar. 12	do	Mar. 13	29.98	W	WNW., 9.	WNW.	NW., 10	W-WNW-NW.
Sarcoxie, Am. S.S	Bordeaux	New York	42 24 N.	17 42 W.	Mar. 10	10a, 12	do	29.68	W	NW., 11	NW	NW., 11	SW-NW.
Caledonia, Br.S.S	Glasgow	do	51 13 N.	31 35 W.	Mar. 13	10a, 13	Mar. 14	29.36	W	WSW, 6	WNW.	WNW, 10.	SW-WSW-W.
Steelmaker, Am.S.S	Swansea	Portland, Me	50 50 N	22 03 W.	do	10p, 13	Mar. 15	29.10	SSW	WNW., 10	NW	WNW, 10.	SSW - WNW-NW.

[1] Position approximate.

[2] Barometer uncorrected.

OCEAN GALES AND STORMS, MARCH 1934—Continued

Vessel	Voyage From—	Voyage To—	Position at time of lowest barometer: Latitude	Position at time of lowest barometer: Longitude	Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
NORTH ATLANTIC OCEAN—Continued			° ′	° ′				Inches					
Ala, Am.S.S.	Rotterdam	Boston	50 22 N.	23 10 W.	Mar. 14	2a, 14	Mar. 17	29.20	NW	NW., 6	WNW	W., 10	None.
Noreg, Nor.M.S.	Oslo	Colon	50 03 N.	3 55 W.	do	Noon, 14	do	28.99	WSW	SW., 10	WNW	NW., 12	
Tuscarora, Br.S.S.	Manchester	Baton Rouge	52 03 N.	6 35 W.	do	3p, 14	do	28.66	S	W., 6	NW	WNW., 11	S-W.
Solana, Am. S.S.	Fall River	Curacao	37 05 N.	70 24 W.	Mar. 15	7p, 15	Mar. 15	29.66	W	WNW, 10	NW	WNW., 10	S-W-NW.
City of Havre, Am.S.S.	Havre	Norfolk	49 35 N.	27 58 W.	do	Mdt. 15	Mar. 17	29.21	NW	S., 11	NNW	S., 11	SW-S-W.
Scanyork, Am.S.S.	Copenhagen	New York	55 30 N.	27 30 W.	Mar. 16	2a, 16	Mar. 16	28.86	W	NW., 7	NW	NW., 11	NW-W.
Volendam, Du.S.S.	Rotterdam	Halifax	49 52 N.	15 43 W.	do	2a, 17	Mar. 17	28.42	W	WSW., 10	NW	NW., 10	WSW-NW.
Minnie de Larrinaga, Br. S.S.	Galveston	Liverpool	49 15 N.	16 00 W.	Mar. 15	do	do	28.79	SSW	NW., 12	NW	WNW., 12	W-WNW.
Independence Hall, Am. S.S.	New York	Havre	48 24 N.	17 23 W.	Mar. 13	3a, 17	do	28.99	WNW	W, 10	NW	WNW., 11	W-WNW.
American Banker, Am. S.S.	do	London	48 18 N.	18 36 W.	Mar. 15	do	do	29.39	SW	NW., 10	NW	WNW., 11	WNW-NW.
Steel Age, Am.S.S.	Cristobal	Liverpool	50 15 N.	13 22 W.	Mar. 16	4a, 17	do	28.40	WNW	W., 8	NW	W., 9	SW-W-NW.
City of Havre, Am.S.S.	Havre	Norfolk	48 30 N.	33 00 W.	Mar. 17	Mdt., 17	Mar. 18	29.28	W	W., 8	WNW	W., 11	SW-W.
Berlin, Ger.S.S.	New York	Galway	48 06 N.	42 20 W.	do	10a., 18	Mar. 19	[2] 29.65	WNW	WNW., 11	NW	WNW, 11	Steady.
Volendam, Du.S.S.	Rotterdam	Halifax	48 55 N.	27 20 W.	Mar. 18	1a, 19	do	28.73	W	WNW, 11	NW	NW., 11	W-NW.
Tuscarora, Br. S.S.	Manchester	Baton Rouge	45 22 N.	19 02 W.	do	3a, 19	do	29.18	W	NW., 9	NW	W., 11	SW-NW.
Lochmonar, Br.M.S.	London	Cristobal	46 40 N.	10 32 W.	Mar. 19	4a. 19	Mar. 20	[2] 28.89	W	W., 7	NNW	NW., 11	W.
Washington, Am.S.S.	New York	Cobh	49 30 N.	23 40 W.	Mar. 17	6a., 19	Mar. 19	28.59	WNW	WNW., 9	NNW	WNW., 10	WNW-NW.
Cuba, Fr.S.S.	Cristobal	Havre	[1] 43 30 N.	[1] 3 47 W.	Mar. 19	2p. 20		29.42	SSW	WSW., 10		WSW., 10	WSW-WNW.
San Juan, Am.S.S.	Puerto Rico	New York	36 40 N.	72 40 W.	Mar. 20	4p. 20	Mar. 20	29.12	NE	NE., 9	NNE	NE., 10	Steady.
Sarcoxie, Am.S.S.	Bordeaux	do	39 26 N.	51 50 W.	Mar. 21	2a., 22	Mar. 22	29.56	S	SSW., 9	WNW	SSW., 10	S-SSW-WNW.
Solana, Am.S.S.	Curacao	Fall River	23 35 N.	69 00 W.	Mar. 25	4p, 25	Mar. 26	30.06	NE	ENE., 8	E	ENE, 8	NE-ENE.
Ensley City, Am.S.S.	Cristobal	Philadelphia	31 41 N.	79 10 W.	Mar. 29	7p, 28	Mar. 30	29.99	NE	NNE., 6	NNE	NNE., 9	
Breedyk, Du.S.S.	Rotterdam	New York	48 18 N.	28 45 W.	do	11p, 29	Apr. 1	29.20	W	NNW., 11	N	NNW., 11	NW-NNW.
City of Joliet, Am.S.S.	do	Tampa	39 55 N.	23 55 W.	Mar. 28	8a, 30	Mar. 31	29.71	NNW	NW., 9	NW	NW, 9	None.
NORTH PACIFIC OCEAN													
Grays Harbor, Am.S.S.	Seattle	Yokohama	51 09 N.	139 22 W.	Mar. 1	10a, Mar. 1.	Mar. 1	28.70	S	SSW, 12	W	SSW, 12	SSW-SW-W.
Kwanto Maru, Jap.M.S.	Yokohama	Los Angeles	46 30 N.	176 25 W.	Mar. 4	11p, 4	Mar. 5	29.33	E	E, 9	NE	ENE, 9	E-ENE-NE.
Bengalen, Du.M.S.	Manila	Vancouver	42 28 N.	156 00 E.	Mar. 6	6a, 6	Mar. 6	29.44	NW	NW, 9	WNW	NW, 9	NW-WNW.
Tahchee, Br.S.S.	Shanghai	Los Angeles	39 54 N.	164 26 E.	do	Noon, 6	Mar. 8	[2] 29.34	W	W, 10	WNW	W, 10	Steady.
Grays Harbor, Am.S.S.	Seattle	Yokohama	52 00 N.	161 00 W.	do	8p, 6	Mar. 6	28.71	E	ESE, 7	E	ENE, 10	E-ESE.
Fernbrook, Nor.M.S.	Port Alberni	do	52 15 N.	167 54 W.	do	1a, 7	do	28.70	NE	ESE, 3	NE	NE, 10	NE-ESE.
Bengalen, Du.M.S.	Manila	Vancouver	45 00 N.	173 30 E.	Mar. 7	11p, 8	Mar. 8	29.30	NNW	NW, 3	NW	NW, 8	
San Pedro, Jap.M.S.	Yokohama	Los Angeles	39 00 N.	150 08 E.	Mar. 9	1a, 10	Mar. 10	29.22	W	WNW, 5	N	W, 10	W-WNW-N.
Laertes, Du.S.S.	Los Angeles	Kobe	28 52 N.	151 22 E.	Mar. 10	4p, 10	Mar. 11	29.99	WNW	WNW, 7	N	NNW, 10	None.
Pres. Jackson, Am.S.S.	Victoria	Yokohama	[1] 49 48 N.	[1] 175 00 E.	Mar. 12	8p, 10	Mar. 12	29.11	N	NW, 4	NNE	N, 8	WNW-NW-N.
Willkeno, Am.S.S.	Los Angeles	Balboa	14 20 N.	95 45 W.	Mar. 11	4p, 11	do	29.84	NE	NNE, 9	N	NNE, 9	
Pres. Hoover, Am.S.S.	Honolulu	San Francisco.	31 47 N.	139 00 W.	Mar. 12	4p, 12	do	29.66	WNW	N, 1	WNW	WNW, 9	W-N-NNE.
Laertes, Du.S.S.	Los Angeles	Kobe	[1] 32 26 N.	[1] 135 13 E.	Mar. 13	3a, 14	Mar. 13	29.64	SE	NNW, 7	W	SSE, 9	
Nevadan, Am.S.S.	do	Balboa	14 40 N.	95 15 W.	do	4a, 14	Mar. 14	29.84	NE	NNE, 8	NNW	N, 8	NE-N.
Pres. Jackson, Am.S.S.	Victoria	Yokohama	39 20 N.	146 20 E.	Mar. 14	2p, 14	Mar. 15	29.21	ESE	SE, 8	NW	SE, 9	SE-NW-N.
Pres. Grant, Am.S.S.	Yokohama	Seattle	46 12 N.	167 05 E.	Mar. 12	4p, 14	Mar. 14	29.46	NNW	NW, 10	WNW	NW, 10	NW-W.
American, Am.S.S.	Balboa	Los Angeles	13 00 N.	94 30 W.	Mar. 15	4a, 15	Mar. 15	29.80	N	N, 7	NE	N, 8	N.
Seattle, Am.S.S.	Legaspi	San Francisco.	32 30 N.	153 30 E.	Mar. 14	6a, 15	do	29.49	S	S, 8	S	SW, 8	SW-S-SW.
Golden Dragon, Am.S.S.	Hondagua, P.I.	do	35 56 N.	163 45 E.	Mar. 15	4a, 16	Mar. 16	29.62	S	S, 8	S	S, 9	None.
Bellingham, Am.S.S.	Taku Bar	Seattle	48 36 N.	174 30 E.	Mar. 17	9p, 17	Mar. 17	29.37	ESE	ESE, 8	ESE	ESE, 9	ESE-SE.
Aorangi, Br.M.S.	Honolulu	Victoria	37 14 N.	142 01 W.	Mar. 19	Mdt, 19	Mar. 19	29.68	WNW	NW, 6	NW	WNW, 9	
Brilliant, Am.M.S.	Los Angeles	Balboa	13 53 N.	95 54 W.	do	4a, 20	Mar. 20	29.91	NE	NNE, 6	NNE	NNE, 8	Steady.
Tyndareus, Br.S.S.	Yokohama	Victoria	38 24 N.	145 54 E.	Mar. 22	10p, 21	Mar. 23	29.15	W	S, 7	WSW	W, 8	S-W.
Michigan, Am.S.S.	Manila	San Francisco.	38 17 N.	168 18 E.	Mar. 23	2p, 23	do	29.73	SSW	SSW, 8	SSW	S, 9	Steady.
Tamaha, Br.S.S.	Japan	Los Angeles	39 50 N.	157 12 W.	do	do	Mar. 24	29.22	NW	NW, 9	WNW	NW, 10	None.
Tyndareus, Br.S.S.	Yokohama	Victoria	48 13 N.	174 25 E.	Mar. 25	4a, 26	Mar. 26	28.87	SE	SW, 7	SW	SW, 9	SE-SW.
Michigan, Am.S.S.	Manila	San Francisco.	[1] 40 55 N.	[1] 162 05 W.	Mar. 27	4a, 28	Mar. 28	29.94	NW	NW, 8	NW	NW, 9	None.
Minnesotan, Am.S.S.	Los Angeles	Balboa	13 06 N.	93 36 W.	Mar. 28	6p, 28	do	29.91	NE	N, 6	N	NE, 8	
Hakonesan Maru, Jap. M.S.	Yokohama	Los Angeles	[1] 42 58 N.	[1] 160 18 E.	Mar. 30	1p, 31	Apr. 2	28.10	E	SSW, 8	W	SSW, 10	SSW-WSW.

[1] Position approximate.

[2] Barometer uncorrected.

NORTH PACIFIC OCEAN, MARCH 1934

By WILLIS E. HURD

Atmospheric pressure.—The average center of the Aleutian LOW in March lay over or slightly to the southward of the Eastern Aleutians, as in the preceding February, but it was much shallower in depth, with average reading of 29.61 inches, at Dutch Harbor. Pressures were below normal in the Bering Sea and neighboring Pacific region, and above normal along the American west coast from the Peninsula of Alaska to Cape Corrientes, Mexico. Averages for other Pacific points were normal, or practically so, except at Manila, which was 0.09 below.

The region occupied by the normal high-pressure belt was subject this month to fluctuating barometric conditions because of numerous intruding depressions including extensions southward of the Aleutian LOW. The crest of the North Pacific anticyclone lay off the upper coast of the United States, and a belt of moderately high pressure extended across the ocean in lower middle latitudes.

A rapid pressure change occurred at Tatoosh Island from 29.68 inches, the minimum reading of the month, on the 5th, to 30.57, the maximum reading, on the 7th. The lowest corrected barometer reading of the month noted on the North Pacific was 28.10 inches, reported by the Japanese motorship *Hakonesan Maru* near 43° N., 160° E., on the 31st.

Table 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, March 1934, at selected stations*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Point Barrow	30.18	+0.03	30.70	21	29.16	2
Dutch Harbor	29.61	−.09	30.18	17	28.64	8
St. Paul	29.69	−.04	30.28	17	29.04	8
Kodiak	29.83	+.14	30.26	4, 22	28.74	1
Juneau	30.01	+.07	30.55	7	28.70	1
Tatoosh Island	30.10	+.14	30.57	7	29.68	5
San Francisco	30.09	+.03	30.33	1	29.80	23
Mazatlan	29.94	+.02	30.02	18	29.84	23, 24
Honolulu	30.02	−.02	30.17	1	29.87	25
Midway Island	30.07	.00	30.32	29	29.74	11
Guam	29.92	+.02	30.00	1, 17	29.84	30
Manila	29.86	−.09	29.96	6, 7, 17	29.76	25, 26
Naha	30.00	.00	30.24	5	29.72	26
Chichishima	30.00	.00	30.28	18	29.76	13–15, 27
Nemuro	29.82	--------	30.36	11	28.66	21

Note.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observation.

Cyclones and gales.—Notwithstanding the considerable prevalence of cyclonic activity in higher and middle latitudes of the ocean, storminess was far less extensive and severe in March than in February. The only gale of the month reported in excess of force 10 was one of hurricane velocity experienced by the American steamer *Grays Harbor* on the 1st, near 51° N., 139° W., in connection with a deep disturbance then covering northeastern waters. The lowest barometer reported was 28.70 inches, which is practically identical with the lowest reading of the month that day at Kodiak and Juneau. Similarly low barometers were reported by ships near the center of a cyclone 200 miles south of Dutch Harbor on the 6th, accompanied by whole northeasterly gales.

Two moderately-intense cyclonic developments occurred during March between the Hawaiian Islands and the California coast. These caused strong gales between about 30° and 40° N., 135° and 145° W., on the 12th and 19th, and less rough weather on adjacent dates.

Altogether, winds of fresh to strong gale force are indicated as being comparatively infrequent, as well as scattered, over the region east of the 180th meridian.

With westward approach to far eastern waters the percentage of high winds showed a moderate increase over those in west longitudes, but gales were well distributed through the month, due in great measure to the successive regularity of cyclones moving eastward after originating in Asia or neighboring Pacific waters. One of the deepest of these cyclones appeared over the Japan Sea on the 20th. On the 21st, with the storm centered over Yezo and the southern Kurils, Nemuro reported a barometer reading of 28.66 inches. On this day fresh to strong gales occurred over the seas surrounding northern and central Japan. The storm thence moved northward, then eastward, and died out in the Bering Sea. The deepest storm of March occurred at the end of the month, when winds of whole gale force were experienced on the 31st, with barometer reported as low as 28.10 inches, near 43° N., 160° E.

Tropical gales.—A press account from Shanghai on the 29th, reported a typhoon over the southernmost seacoast province of China on the 26th which caused the destruction of 300 fishing junks and cost the lives of some 800 fishermen. The weather maps indicate the presence of a shallow LOW in the neighborhood on that date.

In the Gulf of Tehuantepec northers were more active in March than during any other month of the winter. They include a moderate gale (force 7) on the 12th, fresh gales (force 8) on the 14th, 15th, 20th, and 28th, and strong gales (force 9) on the 11th and 13th.

Fog.—Fog occurred on about 15 days along the coast of the Peninsula of California; on about 20 days along the California coast; and thence northward to Vancouver Island on about 6 days. Farther at sea fog was infrequent and scattered over small areas, and was not observed over the great body of the ocean.

CLIMATOLOGICAL TABLES

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Condensed climatological summary of temperature and precipitation by sections, March 1934

[For description of tables and charts, see REVIEW, January, p. 31]

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	54.9	−0.8	3 stations	83	[1] 6	Madison	14	20	6.10	+0.20	Bridgeport	11.90	2 stations	2.86
Arizona	59.7	+5.5	Buckeye	101	30	Bright Angel	11	2	.25	−.70	Henry's Camp	1.45	6 stations	.00
Arkansas	49.6	−2.7	Conway	85	16	Dutton	4	19	6.53	+1.82	Pine Bluff	10.29	Bentonville	2.10
California	58.0	+6.4	Brawley	104	15	Soda Springs	8	1	.80	−2.78	Upper Mattole	6.35	36 stations	.00
Colorado	40.8	+6.4	Eads	89	31	2 stations	−15	8	.49	−.82	Silver Lake	2.65	3 stations	.00
Florida	64.5	−.9	Chapman Field Garden.	90	5	Glen St. Mary	25	12	3.39	+.24	Vernon	8.46	Fort Myers	.75
Georgia	54.8	−1.5	Fargo	88	26	Clayton	10	11	5.31	+.42	Clayton	10.75	Savannah	1.06
Idaho	44.5	+8.6	2 stations	82	[1] 15	Big Springs	−2	17	1.88	+.14	Pete King R.S.	7.94	4 stations	.00
Illinois	37.4	−2.5	Harrisburg	79	30	Lincoln	−14	10	2.34	−.70	Mount Vernon	4.03	Keithsburg	.56
Indiana	36.8	−3.6	4 stations	78	[1] 17	Goshen	−13	28	2.97	−.76	Greensburg	4.42	Hobart	1.25
Iowa	34.4	+.1	Carroll	81	20	Stockport (near)	−13	10	1.09	−.65	Algona	2.41	Riverton (near)	.22
Kansas	44.1	+1.1	Medicine Lodge	90	20	4 stations	4	[1] 8	.70	−.76	Fort Scott	1.87	Claflin	T
Kentucky	43.6	−2.5	Bowling Green	80	17	Farmers	5	11	4.83	+.20	Harlan	11.23	Anchorage	1.98
Louisiana	58.8	−1.6	2 stations	85	[1] 7	Amite	22	11	6.17	+1.40	De Ridder	11.42	Jonesville	2.06
Maryland-Delaware	38.9	−4.1	5 stations	78	18	Oakland, Md.	−10	12	4.45	+1.02	Princess Anne, Md.	7.17	Hancock (City), Md	2.06
Michigan	25.3	−4.3	Monroe	68	17	Garnet	−28	22	1.84	−.33	Benzonia	3.67	Fenville	.53
Minnesota	24.5	−1.8	Winnebago	75	20	Pine River Dam	−29	18	.71	−.47	Pigeon River Bridge	2.20	Argyle	.06
Mississippi	55.2	−1.5	Poplarville	87	23	2 stations	20	[1] 10	5.96	+.19	Waynesboro	8.60	Utica	4.14
Missouri	41.2	−2.4	2 stations	82	20	do	−3	10	2.36	−.78	Bragg City	7.78	Bethany	.05
Montana	35.7	+4.9	Ballantine	79	[1] 12	do	−15	9	1.27	+.32	Heron	4.88	Lima	.03
Nebraska	38.2	+2.0	North Loup	85	16	Newport	−15	23	.72	−.38	Harlington	2.58	3 stations	T
Nevada	50.6	+10.2	Las Vegas	94	30	Zorra Vista Ranch	8	8	.45	−.53	Arthur	1.74	do	.00
New England	30.4	−1.8	Waterbury, Conn.	71	18	East Barnet, Vt.	−21	1	2.99	−.32	Spot Pond, Mass.	5.98	Eustis, Maine	1.18
New Jersey	36.5	−2.6	Long Branch	77	18	Layton	−7	1	3.31	−.47	Dover	4.81	Boonton	1.64
New Mexico	47.1	+3.4	Carlsbad	93	8	Horse Springs	2	17	.47	−.29	Magdalena	3.22	9 stations	.00
New York	30.0	−2.0	Scarsdale	72	18	2 stations	−20	[1] 1	2.83	−.21	New York (City)	4.40	Willsboro	.73
North Carolina	47.7	−2.0	Goldsboro	85	8	Mount Mitchell	−4	11	5.94	+1.73	Highlands	13.35	Charlotte	2.67
North Dakota	26.3	+2.2	Fort Yates	74	[1] 12	3 stations	−12	[1] 9	.49	−.21	New England	1.70	Cando	.02
Ohio	35.3	−3.3	Portsmouth	77	17	Montpelier	−5	28	2.81	−.56	Ironton	4.56	Charlestown	1.19
Oklahoma	49.5	−.9	Hollis	93	20	Boise City	5	18	1.78	−.38	Durant	5.70	Goodwell	.31
Oregon	48.9	+7.8	2 stations	88	9	2 stations	6	7	2.40	−.36	Government Camp	13.66	Harper	.05
Pennsylvania	34.9	−2.8	Lancaster	78	18	Franklin	−22	1	2.96	−.48	Coatesville	5.31	Lakeville	1.13
South Carolina	51.8	−2.8	Ferguson	85	8	2 stations	14	[1] 11	4.28	+.38	Landrum	10.22	Beaufort (near)	1.12
South Dakota	32.6	+1.8	Tyndall	81	20	Cottonwood	−13	6	.96	−.15	Arlington	1.82	Glenham	.30
Tennessee	47.0	−2.2	Carthage	83	17	Elkmont	7	11	8.13	+2.77	Rock Island	12.80	Kenton	3.47
Texas	56.5	−2.2	Fort Stockton	98	7	2 stations	9	18	3.35	+1.27	Orange	13.74	Grandfalls	.00
Utah	46.8	+8.4	St. George	87	[1] 15	Woodruff	7	24	.39	−1.00	Silver Lake	2.20	11 stations	.00
Virginia	42.5	−3.1	2 stations	80	[1] 18	Burkes Garden	−1	12	5.18	+1.48	Wallaceton	8.48	Berryville	2.37
Washington	47.0	+5.1	Wahluke	83	14	2 stations	12	[1] 5	3.99	+.69	Wynoochee Oxbow	16.58	White Swan	.05
West Virginia	38.9	−3.4	Charleston	90	17	Clarksburg	−18	1	4.26	+.38	Beckley	8.09	Upper Tract	1.42
Wisconsin	26.6	−2.6	River Falls	67	20	Long Lake	−30	18	1.50	−.28	Sturgeon Bay	3.89	Ashland	.20
Wyoming	36.2	+6.4	Shoshoni	78	20	Hunter's Station	−11	24	.90	−.27	Snake River	5.28	Wamsutter	T
Alaska (February)	18.3	+8.8	3 stations	58	[1] 15	Allakaket	−38	27	1.99	−.02	View Cove	16.72	2 stations	T
Hawaii	69.4	+.5	Honokaa	95	8	Kanalohuluhulu	37	12	3.83	−5.27	Korean Camp	17.84	Mahukona	.00
Puerto Rico	73.3	−.6	Juncos	92	11	Guineo Reservoir	46	28	4.11	+.63	Guineo Reservoir	9.75	Mona Island	.60

[1] Other dates also.

TABLE 1.—*Climatological data for Weather Bureau stations, March 1934*

[Compiled by Annie E. Small]

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with .01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	Pct.	In.	In.		Miles								0-10	In.	In.
New England							32.3	−0.4										76	3.29	−0.2										5.4		
Eastport	76	67	85	30.05	30.14	+0.21	29.0	+0.1	50	18	36	2	23	22	30	27	23	78	2.32	−1.5	13	8,019	sw.	32	ne.	11	6	14	11	5.6	5.7	1.0
Greenville, Maine	1,070	6	40	28.91	30.13		23.2		48	4	34	−7	10	12	45				1.92		8	4,751	se.	24		23	10	11	10		10.2	
Portland, Maine	103	82	117	30.02	30.15	+.19	31.6	−.2	60	5	40	5	23	23	37	28	22	70	3.86	.0	14	7,006	n.	31	nw.	22	15	10	6	4.0	12.2	T
Concord	289	69					31.6	+.8	62	18	43	2	1	20	41				3.14		12		nw.				6	16	9		6.7	
Burlington	403	11	48	29.70	30.16	+.16	27.2	−1.9	50	18	36	1	23	18	37				1.55	−.5	12	8,834	s.	42	s.	17	6	11	14	6.6	3.1	.1
Northfield	876	12	60		30.16	+.16	26.0	−.4	60	18	39	−7	1	13	46			84	1.39	−1.2	11	6,348	s.	27	sw.	18	8	9	14	6.0	5.0	3.2
Boston	124	336	360	30.01	30.15	+.18	35.1	−.5	68	18	44	6	23	26	42	31	25	70	4.04	+.5	13	11,273	w.	38	w.	6	9	13	9	5.3	10.5	.0
Nantucket	12	14	90	30.13	30.14	+.16	34.6	−.9	55	27	40	13	23	29	19	33	30	83	3.22	−.5	13	12,453	sw.	56	ne.	11	11	11	9	5.1	13.5	.0
Block Island	26	11	46	30.12	30.15	+.17	33.7	−1.7	53	27	39	11	23	28	18	32	30	85	4.17	+.3	11	12,220	sw.	43	ne.	10	8	12	11	5.6	14.4	.0
Providence	160	215	251	29.98	30.16	+.18	35.9	+.2	66	18	45	8	23	27	37	31	25	68	3.82	+.3	13	8,677	nw.	37	sw.	27	14	7	10	4.7	7.3	.0
Hartford	159	70	104		30.18	+.19	35.2	+.2	63	18	44	9	23	26	34				3.84	−.1	15	6,606	s.				9	11	11		9.9	.0
New Haven	106	74	153	30.06	30.18	+.19	35.4	−.4	62	5	44	10	23	27	31	31	26	72	4.68	+.6	14	7,282	n.	27	n.	18	8	11	12	6.1	6.6	.0
Middle Atlantic States							38.9	−1.9										73	4.21	+0.7										6.2		
Albany	97	107	115	30.06	30.17	+.16	32.4	−.3	58	27	42	3	1	23	32	28	22	70	3.13	+.5	13	6,177	s.	22	w.	22	9	6	16	6.2	5.2	.0
Binghamton	871	60	68	29.20	30.16	+.14	32.6	.0	63	17	43	1	12	22	39				3.60	+1.0	13	5,091	nw.	23	w.	6	6	5	20	7.1	5.3	.0
New York	314	415	454	29.81	30.16	+.16	37.2	−.5	69	18	46	11	23	29	42	32	26	66	4.40	+.8	14	10,796	sw.	46	n.	18	7	11	13	6.3	8.5	.0
Bellefonte	1,050	5	42	28.99	30.14		32.0		67	17	44	−13	1	20	49	28	23	74	2.50		12		sw.	38	sw.	6	9	7	15	6.3	5.9	.0
Harrisburg	374	94	104	29.75	30.17	+.14	36.2	−2.7	67	17	46	10	1	27	39	31	25	66	3.34	+.3	15	5,870	w.	34	sw.	6	8	11	12	6.0	6.5	.0
Philadelphia	114	123	367	30.06	30.19	+.17	39.9	−.9	71	18	48	17	23	31	40	34	28	67	2.92	−.5	14	10,351	sw.	40	sw.	6	7	11	13	6.3	10.2	.0
Reading	323	283	306	29.80	30.17		37.2	−2.8	71	18	47	12	1	28	44	32	26	67	4.27	+.8	16	8,483	n.	41	w.	6	9	10	12	5.8	10.0	.0
Scranton	805	72	104	29.26	30.16	+.14	34.6	−1.1	67	17	45	7	12	24	38	30	25	73	2.78	−.4	15	5,501	sw.	21	nw.	22	9	9	13	5.8	8.7	.0
Atlantic City	52	37	172	30.12	30.13	+.16	37.0	−1.6	59	14	43	13	12	31	23	34	31	82	4.68	+1.1	18	12,797	s.	39	n.	20	7	7	17	6.8	15.8	.0
Sandy Hook	22	10	57	30.14	30.16		35.7		68	18	43	11	1	29	37	32	29	79	3.05	−1.0	14	10,678	sw.	38	w.	6	10	8	13	5.8	8.5	.0
Trenton	190	88	106	29.97	30.18		37.0	−2.1	72	18	47	12	12	27	43	32	27	73	2.92	−.5	13	7,731	s.	35	sw.	6	7	13	11	6.0	8.0	.0
Baltimore	123	100	215	30.04	30.17	+.14	40.5	−1.8	78	18	50	16	23	32	42	35	29	70	4.47	+.8	16	7,731	sw.	38	w.	6	6	11	14	6.1	13.8	.0
Washington	112	62	85	30.05	30.18	+.14	41.2	−1.4	78	18	51	16	1	31	42	35	28	65	4.18	+.4	16	5,727	s.	31	nw.	6	11	5	15	6.0	9.1	.0
Cape Henry	18	8	54	30.14	30.16		45.0	−1.6	77	18	53	27	12	37	35	40	37	80	6.10	+2.2	16	10,851	n.	51	ne.	20	9	6	16	6.5	5.2	.0
Lynchburg	686	5		29.40	30.17	+.12	43.0	−4.3	80	18	56	8	1	30	45				5.75	+2.2	18		sw.				9	11	11		1.1	.0
Norfolk	91	170	205	30.08	30.18	+.15	46.0	−2.2	74	18	54	24	12	38	32	41	37	77	6.31	+2.5	16	10,552	ne.	40	nw.	5	6	8	17	6.5	10.8	.0
Richmond	144	11	52	30.02	30.19	+.15	43.4	−3.8	77	18	54	17	1	33	41	38	34	78	4.36	+.7	17	7,074	ne.	37	nw.	6	7	9	15	6.5	2.4	.0
Wytheville	2,304	49	55	27.70	30.15	+.10	39.4	−2.9	68	17	50	11	11	28	40	34	30	74	5.27	+1.8	15	5,319	w.	31	w.	6	10	8	13	6.0	4.2	.0
South Atlantic States							52.6	−1.5										75	3.47	−0.1										5.4		
Asheville	2,253	89	104	27.76	30.16	+.10	44.9	.0	76	7	57	14	11	33	43	39	33	72	5.07	+1.1	14	7,086	se.	30	nw.	8	9	8	14	5.9	.4	.0
Charlotte	779	244	267	29.31	30.17	+.12	47.7	−2.7	75	7	58	22	12	37	34	41	35	70	2.67	−1.5	17	9,952	sw.	35	nw.	8	14	3	14	5.4	.4	.0
Greensboro	886	6	56	29.19	30.17		44.1		77	18	56	15	12	32	43	38	34	76	4.90		17	7,347	ne.	27	ne.	19	11	7	13	5.9	.4	.0
Hatteras	11	5	50	30.14	30.15	+.11	50.0	−2.0	69	18	56	32	16	44	24	47	44	82	5.42	+1.2	12	10,723	ne.	43	nw.	20	12	7	12	5.5	.0	.0
Raleigh	376	103	146	29.76	30.17	+.12	48.2	−2.0	79	7	59	20	12	37	34	42	37	72	5.03	+1.2	15	7,524	sw.	30	n.	20	11	5	15	5.9	10.5	.0
Wilmington	72	73	107	30.09	30.17	+.12	52.0	−1.3	77	8	62	26	12	42	31	47	43	79	4.46	+1.3	10	7,972	sw.	29	sw.	3	11	8	12	5.4	1.0	.0
Charleston	48	11	92	30.10	30.15	+.09	56.0	−1.4	77	8	64	32	12	48	27	51	48	82	1.18	−1.8	9	8,648	ne.	27	sw.	19	10	6	15	5.8	.0	.0
Columbia, S.C.	351	41	57	29.77	30.16	+.10	53.0	−2.2	80	8	63	26	12	42	34	46	40	70	3.16	−.2	11	6,518	ne.	27	sw.	8	15	3	13	4.7	T	.0
Augusta	182	62	77	29.95	30.14	+.08	54.3	−1.7	80	8	66	29	11	43	37	47	41	69	4.48	+.4	8	5,330	ne.	24	sw.	19	14	6	11	4.9	.0	.0
Savannah	65	73	152	30.08	30.15	+.09	58.3	−.7	81	18	68	29	11	48	31	51	48	78	1.06	−2.0	7	8,827	e.	31	sw.	19	15	3	13	5.2	.0	.0
Jacksonville	43	86	110	30.10	30.15	+.09	61.4	−1.2	84	8	71	31	11	52	30	54	51	78	2.18	−.7	6	6,597	ne.	32	w.	19	14	7	10	4.6	.0	.0
Florida Peninsula							70.2	+0.3										76	1.74	−0.2										4.8		
Key West	22	10	64	30.06	30.08	+.03	73.2	+.6	84	4	78	56	12	68	18	66	63	76	1.45	+.1	8	8,225	e.	30	w.	19	13	14	4	4.3	.0	.0
Miami	25	124	168	30.08	30.11	+.03	70.7	+.5	84	5	77	45	12	65	23	64	61	74	1.28	−.9	10	8,063	e.	25	w.	20	9	9	13	5.9	.0	.0
Tampa	35	88	197	30.08	30.12	+.05	66.6	−.2	85	7	76	40	12	57	28	59	56	78	2.49	+.1	8	8,395	n.	35	nw.	20	14	12	5	4.1	.0	.0
Titusville	44	5	25	30.09	30.14		63.9		86	4	73	35	12	54	33				4.83		8		nw.				10	8	13		.0	.0
East Gulf States							56.1	−1.5										74	5.42	+0.2										4.9		
Atlanta	1,173	190	198	28.89	30.15	+.09	50.4	−1.6	76	18	61	20	11	40	34	45	41	77	4.07	−1.2	8	8,179	e.	34	nw.	10	14	4	13	5.1	.5	.0
Macon	370	76	84	29.75	30.15	+.09	54.0	−2.7	79	8	66	24	11	42	38	47	42	69	6.39	+1.4	9	5,837	s.	22	nw.	8	13	7	11	5.2	.0	.0
Thomasville	273	49	58	29.85	30.15	+.09	59.5	−.7	83	25	71	28	11	48	35	53	49	77	3.85	−.2	9		sw.				10	11	10		.0	.0
Apalachicola	35	11	51	30.09	30.13		58.6		75	27	67	32	11	50	30	55			4.40	+.2	7		s.				18	4	9		.0	.0
Pensacola	56	149	185	30.08	30.14	+.08	58.5	−1.8	77	8	66	30	11	51	31	55	53	86	4.24	−.5	9	9,487	se.	44	sw.	3	16	8	7	3.8	.0	.0
Anniston	741	9					53.1	+.6	78	7	66	20	11	41	42				5.48	−.2	8		se.				11	7	13		T	.0
Birmingham	700	11	48	29.36	30.14	+.08	53.2	−2.2	77	31	64	21	11	42	36	46	40	69	8.19	+2.5	9	6,560	s.	25	e.	26	12	8	11	5.1	1.2	.0
Mobile	57	125	161	30.07	30.13	+.07	57.8	−1.9	78	8	67	30	11	49	31	52	49	79	5.93	.0	7	7,970	s.	36	se.	26	15	8	8	4.3	T	.0
Montgomery	218	92	105	29.90	30.15	+.09	57.0	−.8	79	18	68	26	11	46	35	49	43	67	5.09	−.9	9	5,920	se.	26	w.	26	12	7	12	5.4	T	.0
Meridian	375	67	92	29.72	30.13	+.08	55.2	−1.9	80	31	67	24	11	44	37	48	42	69	5.72	+.5	8	5,628	sw.	19	se.	26	12	7	12	5.1	T	.0
Vicksburg	247	65	73	29.86	30.12	+.08	56.4	−2.1	79	7	67	29	11	46	34	49	43	68	5.71	+.1	7	6,190	s.	21	w.	26	8	13	10	5.7	T	.0
New Orleans	53	76	84	30.07	30.13	+.09	61.6	−1.2	82	7	71	35	11	52	33	55	50	74	5.93	+1.2	7	5,812	se.	20	ne.	27	18	5	8	4.1	.0	.0
West Gulf States							56.6	−2.6										70	4.95	+2.1										4.1		
Shreveport	249	92	227	29.84	30.12	+.10	56.8	−1.5	82	7	67	31	19	46	32	49	43	67	9.30	+5.2	8	8,844	s.	35	w.	26	14	8	9	4.7	T	.0
Bentonville	1,303	11	44	28.70	30.10	+.09	44.7	−2.6	76	16	56	14	10	33	41				2.10		9	5,937	ne.	21	ne.	13	10	5	16		5.5	.0
Fort Smith	457	79	94	29.61	30.10	+.09	50.0	−2.6	80	16	62	20	10	38	42	42	35	63	2.83	−.2	9	6,967	e.	30	sw.	17	13	7	11	5.1	1.7	.0
Little Rock	357	94	102	29.75	30.13	+.10	49.7	−3.3	78	6	60	22	10	39	39	42	35	64	6.84	+2.2	9	7,106	sw.	25	nw.	17	14	3	14	5.2	2.0	.0
Austin	605	136	148	29.44	30.08		58.9	−1.8	84	22	72	30	18	46	50	50	43	65	3.82	+1.5	6	7,629	s.	30	s.	17	17	8	6	3.8	T	.0
Brownsville	57	88	96	30.00	30.06		64.0	−4.2	82	6	73	38	18	55	32	58	55	80	2.31	+1.0	6	8,931	se.	41	nw.	18	19	5	7	3.5	.0	.0
Corpus Christi	20	11	78	30.08	30.10	+.12	62.2	−2.8	77	22	71	37	19	54	32	56	53	80	1.67	+.1	7	8,677	s.	31	s.	17	16	9	6	3.9	.0	.0
Dallas	512	220	227	29.44	30.09		54.2		88	22	65	27	10	43	45	47	41	66	3.11	+.2	7	10,184	se.	36	nw.	18	15	8	8	4.1	.7	.0
Fort Worth	670	106	114	29.38	30.11	+.13	54.8	−2.9	93	22	67	26	18	42	50				4.26	+1.9	8	7,428	s.	29	s.	20	22	3	6	2.9	.0	.0
Galveston	54	106	114	30.04	30.10	+.09	60.6	−1.8	75	6	67	37	19	54	29	56	54	85	7.29	+4.6	8	7,977	s.	34	nw.	26	19	5	7	3.6	.0	.0
Houston	138	292	314	29.96	30.11		61.1	−2.2	81	6	71	31	18	51	34				4.46	+1.0	7	9,169	s.	36	se.	1	13	11	7	4.2	.0	.0
Palestine	510	64	72	29.57	30.10	+.10	56.0	−3.1	82	7	67	27	18	45	46	49	42	67	5.78	+2.3	8	7,021	s.	27	s.	17	16	7	8	4.3	1.2	.0
Port Arthur	34	58	66	30.06	30.10		60.6		76	24	69	35	19	52	30				10.66	+7.4	10	6,782	s.	27	nw.	26	13	11	7	4.5	.0	.0
San Antonio	693	242	301	29.34	30.06	+.08	61.0	−1.8	85	7	74	31	18	48	42	51	42	59	2.05	+.2	6	9,230	s.	36	n.	8	18	8	5	3.4	.0	.0

TABLE 1.—*Climatological data for Weather Bureau stations, March 1934*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F		°F	°F.		°F	°F.	°F.	°F.	m	In.	In.		Miles								0-10	In.	In.
Ohio Valley and Tennessee							**42.0**	**-2.6**										**69**	**4.70**	**-0.4**											**15.9**	
Chattanooga	762	71	214	29.32	30.14	+0.08	50.4	-.8	78	7	61	20	11	40	36	44	37	65	11.01	+5.2	13	6,795	ne.	28	w.	19	12	9	10	5.5	0.8	.0
Knoxville	995	66	84	29.06	30.14	+.08	48.4	-.3	74	18	59	20	11	38	35	41	35	66	7.79	+2.7	14	5,256	sw.	28	sw.	5	11	7	13	5.6	1.2	.0
Memphis	399	78	86	29.70	30.13	+.09	49.2	-3.1	75	17	58	20	10	40	30	44	39	73	6.38	+1.1	9	7,014	sw.	28	n.	10	14	5	12	5.0	.5	.0
Nashville	546	168	191	29.56	30.16	+.11	47.2	-2.0	75	17	57	20	11	37	35	41	35	68	7.99	+2.9	14	7,669	s.	32	se.	26	8	9	14	6.2	.1	.0
Lexington	989	5					40.6	-3.1	76	17	51	11	11	30	38				3.86	-.5	16		ne.				12	6	13		4.5	.0
Louisville	525	188	234	29.58	30.17	+.12	42.4	-3.0	75	17	52	16	11	32	35	36	29	65	3.60	-.8	12	8,978	s.	37	s.	5	11	10	10	5.2	4.5	.0
Evansville	431	76	116	29.68	30.16	+.12	42.2	-3.7	72	17	51	12	10	33	32	37	30	66	2.95	-1.2	14	7,814	n.	32	sw.	17	9	6	16	6.2	4.1	.0
Indianapolis	822	194	230	29.25	30.16	+.12	35.3	-4.7	72	17	44	8	10	26	42	31	23	63	3.32	-.6	16	8,946	s.	43	w.	5	7	12	12	5.9	9.1	.0
Terre Haute	575	96	129	29.52	30.16		37.2		73	17	47	6	10	28	44	33	28	72	3.87	+.1	17	8,331	s.	39	w.	5	11	8	12	5.8	12.1	.0
Cincinnati	627	11	51	29.46	30.16	+.11	39.4	-1.5	76	17	50	10	11	29	43	33	28	70	2.83	-1.1	12	6,964	ne.	30	sw.	5	9	8	14	6.4	6.6	.0
Columbus	822	216	230	29.25	30.15	+.11	37.2	-1.9	72	17	47	10	11	28	41	32	26	69	2.20	-1.3	12	8,948	s.	40	w.	6	7	11	13	6.0	6.8	.0
Elkins	1,947	59	78	28.07	30.20	+.15	37.2	-2.8	69	17	49	-1	12	25	46	32	28	79	4.66	+.9	20	4,993	n.	32	w.	5	6	7	18	6.8	16.1	.0
Parkersburg	637	77	84	29.52	30.19	+.14	39.4	-3.4	73	17	51	7	12	27	42	33	28	72	3.19	-.3	13	5,300	se.	27	nw.	5	8	6	17	6.5	11.7	.0
Pittsburgh	842	353	410	29.23	30.16	+.12	36.5	-3.1	70	30	46	9	11	26	44	31	25	69	2.15	-.9	12	8,170	sw.	41	w.	5	10	7	14	6.2	7.6	.0
Lower Lake Region							**30.7**	**-2.3**										**72**	**2.68**	**0.0**										**6.7**		
Buffalo	768	243	280	29.27	30.13	+.11	28.6	-2.5	60	17	36	6	22	22	28	26	22	78	2.32	-.2	19	11,776	sw.	57	sw.	6	4	10	17	7.0	4.0	.0
Canton	448	10	61	29.62	30.12		26.1	-1.6	55	31	34	-2	22	18	38				3.28	+.8	14	7,420	sw.	31	w.	6	7	8	16	6.7	6.6	T
Ithaca	836	77	100	29.21	30.14		32.2	+.4	62	4	42	5	23	22	36	28	22	69	3.05	+.7	17	7,734	nw.	30	s.	27	5	7	19	7.2	7.4	.0
Oswego	335	71	85	29.76	30.15	+.14	30.0	-1.2	61	17	38	5	23	22	34	26	21	71	2.47	-.1	19	8,080	s.	30	w.	6	3	9	19	7.6	11.7	.0
Rochester	523	86	102	29.56	30.15	+.13	31.6	-.2	66	17	40	8	23	24	36	27	20	67	1.74	-1.0	17	5,949	w.	30	w.	6	6	10	15	6.7	5.8	.0
Syracuse	596	65	79	29.50	30.17	+.15	32.4	+1.0	62	17	41	4	23	23	44				3.18	+.2	17	6,235	s.	24	s.	27	4	9	18	7.3	9.0	.0
Erie	714	130	166	29.35	30.14	+.12	30.8	-2.7	69	17	38	9	23	23	33	28	24	75	2.36	-.3	15	10,233	n.	41	sw.	6	8	10	13	5.9	5.5	.0
Cleveland	762	267	337	29.29	30.14	+.11	32.2	-2.4	72	17	40	13	23	24	37	28	23	70	2.43	-.3	16	10,214	n.	38	s.	13	7	10	14	6.3	3.2	.0
Sandusky	629	5	67	29.46	30.17	+.14	32.6	-2.5	71	17	41	11	11	24	37				2.95	+.2	14	7,531	sw.	29	sw.	6	6	9	16	6.6	4.4	.0
Toledo	628	79	87	29.45	30.16	+.13	31.2	-4.1	67	17	39	11	28	24	35	27	22	70	2.76	+.2	14	7,917	sw.	32	w.	5	7	13	11	5.7	9.1	.0
Fort Wayne	857	69	84	29.20	30.16		31.8	-7.1	68	17	40	9	11	24	39	28	23	73	2.75	-.5	12	7,659	nw.	34	w.	5	6	9	16	6.6	10.1	.0
Detroit	626	5	78	29.44	30.15	+.12	29.2	-4.2	66	17	38	3	27	20	39	25	20	72	2.89	+.5	15	8,219	sw.	34	sw.	6	6	6	19	6.7	13.1	.6
Upper Lake Region							**25.0**	**-3.2**										**76**	**1.83**	**-0.3**										**6.6**		
Alpena	609	13	89	29.44	30.13	+.10	22.0	-3.5	47	4	30	-3	23	14	32	20	16	78	2.22	+.2	10	8,556	nw.	31	sw.	6	7	9	15	6.4	15.9	1.5
Escanaba	612	54	60	29.44	30.14	+.10	21.9	-2.3	48	4	30	-3	18	14	30	20	16	80	1.68	-.2	13	8,331	s.	32	n.	21	9	4	18	6.5	12.1	4.0
Grand Rapids	707	70	244	29.35	30.15	+.12	29.0	-4.4	50	17	36	9	22	22	34	25	19	67	1.63	-.8	10	9,282	s.	33	w.	6	8	8	15	6.5	1.7	.0
Lansing	878	6	88	29.16	30.14		27.1	-5.1	57	13	36	-4	28	18	36	25	22	85	1.88	-.5	9	7,919	s.	32	w.	6	5	10	16	6.8	12.6	T
Ludington	637	5	54																													
Marquette	734	77	111	29.28	30.11	+.07	22.0	-2.8	48	4	30	-2	11	14	32	19	17	83	2.30	.0	18	7,621	w.	36	s.	15	6	4	21	7.6	20.8	12.5
Sault Sainte Marie	614	11	52	29.41	30.14	+.11	17.4	-4.2	37	6	27	-14	23	8	35	17	14	86	2.06	+.2	19	6,786	nw.	32	nw.	7	7	6	18	7.1	22.2	12.0
Chicago	673	7	131	29.40	30.15	+.12	32.9	-2.4	64	13	39	10	10	26	35	29	23	69	1.21	-1.4	7	9,004	sw.	30	w.	5	6	10	15	6.5	7.3	.0
Green Bay	617	109	141	29.43	30.12	+.08	26.4	-2.2	50	15	35	4	18	18	33	23	17	69	2.37	+.3	11	9,641	s.	40	w.	5	6	8	17	6.8	12.3	6.5
Milwaukee	681	97	221	29.37	30.13	+.10	30.2	-1.9	55	15	38	8	10	23	31	27	20	65	1.97	-.4	9	10,567	w.	35	sw.	15	9	9	13	6.1	7.1	T
Duluth	1,133	5	47	28.84	30.11	+.05	20.6	-3.1	48	4	30	-9	18	11	30	18	14	78	.96	-.6	5	9,890	w.	50	nw.	5	9	11	11	5.7	9.4	T
North Dakota							**26.0**	**+3.6**										**71**	**0.62**	**-0.2**										**5.8**		
Moorhead, Minn	940	50	58	29.09	30.15	+.07	24.2	+1.5	61	12	35	-5	17	14	38	21	15	71	.83	-.2	6	7,980	s.	29	nw.	5	7	13	11	6.3	5.1	.0
Bismarck	1,674	8	57	28.30	30.15	+.09	28.2	+4.0	69	12	40	-3	9	16	49	23	17	69	.62	-.3	7	7,793	nw.	32	nw.	5	6	16	9	5.9	4.2	.0
Devils Lake	1,478	11	44	28.50	30.14	+.09	23.0	+3.2	55	12	34	-6	17	12	41	19	14	73	.43	-.4	9	8,649	nw.	35	nw.	5	5	16	10	6.1	1.8	.0
Grand Forks	833	12	67				21.6		53	12	32	-7	24	11	33	19			.29		4		nw.	35	nw.	5	9	13	9		2.8	T
Williston	1,878	41	48	28.10	30.15	+.11	28.8	+5.9	60	11	38	-6	9	19	41	25	19	70	.62	-.1	7	7,334	nw.	32	nw.	5	11	15	5	4.8	5.5	.0
Upper Mississippi Valley							**34.5**	**-1.8**										**67**	**1.99**	**-0.4**										**5.7**		
Minneapolis	918	102	208	29.10	30.12		29.0	- 6	65	20	39	2	9	19	35	24	16	61	.68	-.7	10	9,483	nw.	37	nw.	5	6	12	13	6.3	5.9	.5
La Crosse	714	11	48	29.32	30.12	+.08	30.5	-1.0	65	20	41	5	10	20	39	25	19	67	1.58	.0	8	5,518	s.	23	nw.	5	10	10	11	5.7	12.9	6.8
Madison	974	70	78	29.04	30.13	+.09	29.1	-1.5	57	12	38	7	10	21	31	26	20	72	1.65	-.4	9	7,601	nw.	28	nw.	5	10	8	13	5.8	4.6	1.2
Charles City	1,015	10	51	29.02	30.14	+.09	30.6	-.1	69	20	42	4	10	20	40	25	17	63	1.85	+.1	7	6,714	n.	27	nw.	5	12	11	8	4.9	6.5	3.5
Davenport	606	66	161	29.47	30.15	+.12	35.1	-1.0	64	30	44	8	10	26	33	30	23	64	1.50	-.8	11	8,173	sw.	35	nw.	5	9	9	13	6.0	2.5	.0
Des Moines	861	5	99	29.21	30.15	+.11	35.0	-.9	71	20	45	5	10	25	45	30	23	65	1.00	-.8	10	8,241	n.	32	w.	5	8	10	13	6.0	6.2	T
Dubuque	700	81	96	29.36	30.14	+.10	32.8	-1.2	62	12	42	10	10	24	33	28	21	65	1.72	-.3	9	5,963	nw.	30	nw.	5	10	9	12	5.8	1.8	.0
Keokuk	614	64	78	29.48	30.18	+.15	36.7	-2.2	69	20	47	0	10	27	37	31	25	67	1.77	-.6	12	7,061	n.	30	n.	5	8	6	17	6.1	9.5	.0
Cairo	358	87	93	29.75	30.14	+.10	44.4	-2.8	74	17	54	14	10	35	36	39	32	66	3.86	+1.1	16	8,358	n.	31	n.	9	8	10	13	6.1	1.4	.0
Peoria	609	11	45	29.48	30.17	+.14	34.1	-2.9	68	30	44	-1	10	24	36	30	25	72	1.76	-1.0	10	6,484	s.	28	w.	5	13	9	9	4.9	14.7	.0
Springfield, Ill	636	5	191	29.45	30.15	+.12	36.4	-3.8	70	13	46	5	10	27	39	32	27	73	3.50	+.3	12	9,420	s.	37	nw.	5	9	10	12	5.9	15.7	.0
St. Louis	568	265	303	29.52	30.14	+.11	40.8	-3.0	73	13	50	13	10	31	41	34	28	65	2.96	-.4	13	9,463	ne.	35	sw.	12	12	8	11	5.3	4.5	.0
Missouri Valley							**38.4**	**-0.2**										**62**	**1.31**	**-0.6**										**5.4**		
Columbia, Mo	784	6	84	29.30	30.15	+.12	39.8	-2.8	76	20	50	13	10	30	39				2.91	.0	12	7,476	n.	27	n.	26	11	10	10	5.3	8.8	.0
Kansas City	750	32	45	29.31	30.14	+.12	41.8	-.9	79	20	54	14	10	30	45	35	27	63	.65	-1.9	8	8,946	sw.	32	n.	13	8	14	9	5.6	1.0	.0
St. Joseph	967	11	49	29.08	30.14		40.6		82	20	53	10	10	28	49	33	24	60	.43	-1.6	7	7,379	ne.	28	n.	13	11	11	9	5.2	2.3	.0
Springfield, Mo	1,324	98	104	28.69	30.12	+.10	42.2	-3.0	74	20	53	12	10	31	40	36	31	70	2.76	-.6	9	8,387	s.	25	nw.	9	16	5	10	4.6	5.2	.0
Iola	984	11	50	29.07	30.14	+.13	44.4	-.1	80	20	59	12	10	30	54				1.52	-1.1	5		n.				10	11	10		T	.0
Topeka	987	65	87				42.2	-.4	84	20	55	11	18	29	49				.76	-1.3	6	8,098	s.	30	n.	13	12	11	8	4.7	2.9	.0
Lincoln	1,189	11	81	28.84	30.14	+.12	38.0	+.5	79	20	50	8	18	26	49	31	23	61	.80	-.5	7	8,187	n.	29	n.	17	7	10	14	6.1	6.1	.0
Omaha	1,105	170	200	28.94	30.16	+.12	37.4	+.4	78	20	49	8	10	26	41	30	22	59	.77	-.6	8	9,399	n.	38	n.	17	10	8	13	5.8	7.0	.2
Valentine	2,598	47	54	27.37	30.16	+.13	33.0	+.7	71	19	46	-1	24	20	61	28	21	66	1.56	+.5	8	7,529	w.	31	n.	16	8	13	10	6.0	14.8	1.0
Sioux City	1,138	64	106	28.89	30.15	+.10	34.0	+1.3	74	20	45	2	10	23	48	28	20	62	1.36	+.2	10	8,107	nw.	34	nw.	16	8	10	13	6.1	9.4	1.3
Huron	1,306	60	74	28.71	30.16	+.10	30.8	+1.9	72	12	43	1	17	18	57	25	17	61	.84	-.1	8	8,323	n.	30	n.	16	14	11	6	4.6	8.9	2.3
Northern Slope							**36.8**	**+5.4**										**65**	**1.11**	**+0.1**										**6.0**		
Billings	3,140	4					38.6		72	12	54	8	8	24	45				1.50		10		nw.				7	9	15		11.0	.0
Havre	2,505	11	67	27.44	30.15	+.15	32.6	+5.5	65	18	43	-7	9	22	38	28	22	71	1.05	+.5	11	7,555	e.	38	w.	2	5	16	10	6.1	15.3	T
Helena	4,124	85	111	25.84	30.10	+.09	38.0	+5.6	64	12	49	13	17	27	37	32	25	61	.93	+.1	13	6,625	w.	36	sw.	6	4	13	14	6.7	9.7	T
Kalispell	2,973	48	56	27.00	30.09	+.10	39.9	+7.0	64	18	50	22	24	30	33	35	29	70	2.72	+1.8	12	4,958	nw.	26	nw.	2	6	11	14	6.4	17.4	4.1
Miles City	2,371	48	55	27.56	30.18	+.16	34.8	+6.2	69	19	46	3	9	24	40	29	22	65	1.05	+.2	7	5,957	s.	29	nw.	4	7	16	8	5.7	8.2	T
Rapid City	3,259	50	58	26.66	30.18	+.17	33.9	+1.3	74	11	46	3	17	21	49	29	23	70	.64	-.3	10	6,710	n.	32	nw.	4	9	12	10	5.7	6.6	.0
Cheyenne	6,094	50	71	24.01	30.08	+.12	37.8	+4.7	65	19	50	9	17	26	46	31	24	62	.86	-.2	16	9,982	w.	38	w.	2	5	11	15	6.4	6.7	.0
Lander	5,372	60	68	24.67	30.08	+.09	39.4	+7.0	66	12	53	3	17	26	43	33	25	62	.92	-.3	6	4,971	w.	45	sw.	2	9	16	6	4.8	10.5	.0
Sheridan	3,790	10	47	26.14	30.12		35.9		70	11	49	-5	24	23	50	30	23	66	1.61	+.4	12	5,102	nw.	30	nw.	4	8	11	12	5.8	11.0	.0
Yellowstone Park	6,241	11	48	23.91	30.12	+.10	35.8	+9.3	59	14	47	8	17	25	39	29	22	61	.96	-.7	12	6,295	sw.	25	sw.	2	5	11	15	6.9	3.9	.0
North Platte	2,821	11	51	27.14	30.12	+.12	38.9	+2.3	78	16	53	10	17	25	61	32	24	64	.36	-.5	6	7,054	w.	32	n.	16	6	16	9	5.8	1.5	.0

TABLE 1.—*Climatological data for Weather Bureau stations, March 1934*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F		°F	°F.		°F.	°F.	°F.	°F.	m	In.	In.		Miles								0-10	In.	In.
Middle Slope							**44.6**	**+1.4**										**57**	**0.72**	**−0.5**										**5.6**		
Denver	5,292	106	113	24.75	30.06	+0.11	43.8	+4.5	68	6	57	13	17	31	48	34	23	51	1.00	0.0	10	6,758	s.	35	n.	16	5	16	10	6.3	8.7	0.0
Pueblo	4,685	80	86	25.33	30.06	+.14	45.4	+3.8	76	19	61	13	8	30	48	35	23	51	.38	−.2	5	5,724	n.	40	n.	31	7	19	5	5.4	3.5	.0
Concordia	1,392	50	58	28.65	30.16	+.15	41.0	.0	83	20	53	11	18	29	47	34	26	63	.29	−.9	4	7,233	ne.	31	ne.	13	11	9	11	5.2	1.2	.0
Dodge City	2,509	10	86	27.48	30.13	+.16	43.9	+1.1	79	20	58	10	18	30	47	35	26	59	.52	−.4	4	9,555	ne.	39	n.	17	12	9	10	5.0	2.7	.0
Wichita	1,358	85	93	28.65	30.12	+.13	45.0	−.1	85	20	58	13	18	32	47	36	26	56	1.16	−.6	5	9,547	sw.	31	sw.	16	11	7	13	5.7	.2	.0
Oklahoma City	1,214	10	47	28.80	30.11	+.13	48.8	−1.2	86	20	62	19	10	36	47	40	32	61	.95	−1.0	6	8,549	s.	33	n.	17	12	6	13	6.1	.1	.0
Southern Slope							**54.3**	**−0.2**										**52**	**1.94**	**+1.1**										**3.8**		
Abilene	1,738	10	52	28.26	30.08	+.12	54.4	−2.1	92	22	68	25	18	41	46	43	32	55	3.23	+1.9	6	8,349	s.	31	s.	17	17	6	8	4.1	.2	.0
Amarillo	3,676	10	49	26.32	30.08	+.13	49.1	+2.2	84	6	64	18	18	34	47	37	25	50	2.83	+2.1	6	7,338	ne.	26	n.	17	13	11	7	4.3	21.5	.0
Big Spring	2,537	5	62	27.44	30.08		53.4		89	22	69	24	18	38	50	42	31	55	1.82		3		s.				18	7	6	3.5	T	.0
Del Rio	944	64	71	29.04	30.03	+.08	62.0	−1.5	90	22	76	34	19	47	45	50	39	52	.59	−.1	3	7,815	se.	38	n.	17	22	4	5	3.0	.0	.0
Roswell	3,566	75	85	26.42	30.05	+.15	51.7	+.4	84	6	68	21	18	35	52	40	25	47	1.12	+.4	4	6,497	s.	40	ne.	3	16	8	7	4.2	2.2	.0
Southern Plateau							**58.3**	**+7.5**										**40**	**0.17**	**−0.4**										**3.1**		
El Paso	3,778	152	175	26.23	30.01	+.13	58.0	+2.2	83	31	73	29	18	43	42	43	24	35	.24	−.1	3	7,611	w.	39	ne.	17	26	1	4	2.0	T	.0
Albuquerque	4,972	5	39	25.08	29.98		49.3		79	29	67	19	18	32	48	37	24	42	.01		1	7,185	n.	42	nw.	4	16	11	4	3.7	T	.0
Santa Fe	7,013	38	53	23.28	30.01	+.12	44.4	+4.7	70	29	58	15	18	30	39	34	21	44	T	−.8	0	5,060	e.	25	sw.	31	15	14	2	3.6	T	.0
Flagstaff	6,907	10	59	23.40	29.98	+.07	44.8	+8.9	70	29	62	17	9	28	47	35		53	.40		3	6,398	sw.	31	ne.	1	6	19	6		.0	.0
Phoenix	1,108	10	107	28.80	29.94	+.03	70.0	+9.3	95	30	86	47	2	54	38	51	31	30	.10	−.6	1	4,534	e.	21	ne.	17	15	13	3	3.8	.0	.0
Yuma	141	9	54	29.78	29.98	+.04	73.0	+8.9	99	30	90	50	2	56	45	55	37	34	.18	−.2	1	3,930	n.	22	n.	8	25	6	0	2.2	.0	.0
Independence	3,957	5	26	26.05	30.08	+.14	59.7	+11.2	83	30	76	34	8	44	41	44			.30	−.2	1		nw.				22	5	4		.0	.0
Middle Plateau							**49.7**	**+8.8**										**42**	**0.37**	**−0.7**										**4.5**		
Reno	4,532	74	81	25.56	30.07	+.09	52.4	+11.4	76	15	68	28	8	37	44	42	31	50	.09	−.7	2	4,719	w.	25	w.	26	15	9	7	4.5	.0	.0
Tonopah	6,090	12	20				52.0		70	30	62	33	7	42	26	39	23	35	.01		1		w.								.0	.0
Winnemucca	4,344	18	56	25.72	30.13	+.12	48.6	+8.6	76	14	66	23	18	32	50	38	26	49	.66	−.3	6	6,046	sw.	30	nw.	28	12	12	7	4.4	.0	.0
Modena	5,473	10	46	24.68	30.04	+.08	46.8	+8.6	73	14	65	13	8	28	52	35	18	39	.06	−1.0	2	7,055	w.	30	nw.	2	12	9	10	5.0	.0	.0
Salt Lake City	4,360	86	210	25.71	30.09	+.11	50.6	+8.9	71	19	61	30	8	41	36	40	28	44	.96	−1.0	5	5,223	nw.	38	nw.	29	13	12	6	4.3	T	.0
Grand Junction	4,602	60	68	25.42	30.01	+.07	50.2	+6.6	73	28	65	25	9	36	37	38	23	38	.09	−.7	2	4,789	se.	30	n.	7	13	13	5	4.3	.0	.0
Northern Plateau							**49.2**	**+8.0**										**56**	**1.04**	**−0.1**										**5.2**		
Baker	3,471	48	53	26.55	30.16	+.13	45.6	+8.0	73	13	59	22	24	32	40	39	32	62	.55	−.6	7	5,473	se.	25	w.	2	10	12	9	4.9	T	.0
Boise	2,739	79	87	27.27	30.15	+.12	50.6	+7.9	73	15	63	29	17	39	37	42	31	52	.88	−.5	8	3,969	se.	22	nw.	16	12	9	10	5.0	.0	.0
Pocatello	4,477	60	68	25.54	30.08	+.07	47.4	+10.0	71	19	59	19	24	36	43	38	26	47	.37	−.9	7	7,936	sw.	30	sw.	4	13	9	9	4.8	.6	.0
Spokane	1,929	101	110	28.03	30.10	+.09	47.2	+7.5	67	14	58	25	24	36	33	40	32	61	1.53	+.3	5	5,071	s.	26	sw.	2	10	11	10	5.6	.0	.0
Walla Walla	991	57	65	29.04	30.12	+.10	53.4	+7.3	74	14	63	32	23	43	32	46	37	57	2.29	+.7	10	4,384	s.	29	w.	2	12	9	10	5.1	.0	.0
Yakima	1,076	58	67	28.96	30.12		51.2	+7.1	77	14	64	28	24	38	35	43	34	56	.60	+.2	6	3,907	nw.	26	w.	3	12	9	10	5.6	.0	.0
North Pacific Coast Region							**52.6**	**+7.2**										**74**	**4.18**	**0.0**										**6.7**		
North Head	211	11	56	29.89	30.12	+.11	50.3	+5.1	73	10	55	40	17	46	23	48	45	86	6.22	+.7	14	9,509	n.	49	s.	1	8	6	17	6.7	.0	.0
Seattle	125	90	321	29.98	30.11	+.12	52.0	+7.1	69	13	60	39	25	44	27	46	41	70	2.65	−.4	13	6,865	n.	45	sw.	5	6	12	13	6.4	.0	.0
Tatoosh Island	86	10	54	30.00	30.10	+.14	48.8	+5.9	67	9	52	40	5	45	20	46	43	83	8.22	+.4	13	11,559	e.	50	s.	1	6	4	21	7.4	.0	.0
Medford	1,329	29	58	28.69	30.10		55.0		80	10	70	28	7	40	48	48	41	64	1.15	−.6	7	3,536	nw.	21	nw.	24	9	4	18	6.5	.0	.0
Portland, Oreg.	153	68	106	29.96	30.12	+.10	55.2	+8.3	76	12	64	38	17	46	30	49	43	68	5.18	+1.3	14	4,691	nw.	21	e.	23	8	9	14	6.3	.0	.0
Roseburg	510	45	76	29.57	30.12	+.08	56.5	+9.4	80	12	68	33	17	44	39	51	46	73	1.65	−1.6	11	2,799	n.	20	sw.	21	3	16	12	6.8	.0	.0
Middle Pacific Coast Region							**59.9**	**+7.3**										**74**	**1.24**	**−2.3**										**5.5**		
Eureka	62	73	89	30.08	30.15	+.09	54.2	+5.9	72	8	59	41	7	49	28	52	51	90	3.61	−1.6	10	4,098	n.	23	n.	6	3	9	19	7.3	.0	.0
Red Bluff	330	5	58	29.72	30.08	+.04	63.2	+9.6	87	9	76	42	1	51	38	54	46	61	1.13	−2.1	6	4,058	nw.	20	nw.	6	10	8	13	5.7	.0	.0
Sacramento	66	87	115	30.00	30.08	+.05	61.5	+7.2	81	11	73	45	1	50	33	55	50	70	.13	−2.4	3	4,770	s.	18	nw.	31	16	14	1	3.6	.0	.0
San Francisco	155	208	243	29.92	30.09	+.03	60.6	+6.4	81	11	68	49	1	53	27	60	51	77	.07	−3.1	2	4,403	w.	22	w.	23	8	16	7	5.4	.0	.0
South Pacific Coast Region							**63.7**	**+7.3**										**69**	**0.08**	**−2.0**										**4.9**		
Fresno	327	97	105	29.71	30.07	+.06	63.8	+8.8	85	18	77	45	1	51	33	56	49	64	T	−1.6	0	3,860	nw.	17	nw.	28	12	12	7	4.6	.0	.0
Los Angeles	338	159	191	29.66	30.03	+.01	65.5	+8.0	92	10	76	51	8	55	37	55	48	64	.01	−2.8	1	3,884	se.	14	e.	8	13	14	4	4.1	.0	.0
San Diego	87	62	70	29.92	30.01	−.01	61.8	+5.1	85	9	69	48	13	54	28	56	53	79	.24	−1.5	3	4,468	nw.	18	nw.	27	9	6	16	5.9	.0	.0
West Indies																																
San Juan, P.R.	82	9	54	29.93	30.02		75.2	−.2	85	19	81	67	12	70	17				2.42	−.7	23	8,476	e.	31	e.	11	6	23	2	5.3	.0	.0
Panama Canal																																
Balboa Heights	118	6	97		[1]29.86	+.01	80.3	−.9	92	22	90	68	5	71	23			[1]72	.20	−.5	1	7,277	nw.	24	n.	19	18	13	0	3.6	.0	.0
Cristobal	36	6	97		[1]29.89	+.01	81.1	−.4	86	31	85	74	25	77	11	73	71	[1]73	1.10	−.5	13	10,980	n.	25	nw.	16	18	13	0	3.5	.0	.0
Alaska																																
Fairbanks	454	11	87	[2]29.50	[2]30.05		9.2		50	30	24	−39	4	−6	49	10	2	66	.43		8	3,296	s.	19	w.	13	11	6	14	5.8	9.1	17.5
Juneau	80	96	116	[2]29.91	[2]30.00		36.2		57	10	42	18	7	31	20	33	25	65	4.65		18	5,963	w.	27	ne.	28	10	4	17	6.3	7.8	.0
Hawaiian Islands																																
Honolulu	38	86	100	[2]29.98	[2]30.02		71.8	+.4	81	1	77	63	25	67	14	66	62	74	.65	−2.6	10	6,166	ne.	24	ne.	29	13	13	5	4.5	.0	.0

[1] Observations taken bihourly.
[2] Pressure not reduced to mean of 24 hours.

TABLE 2.—*Data furnished by the Canadian Meteorological Service*

MARCH 1934

Stations	Altitude above mean sea level, Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*In.*	*In.*	*In.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	*In.*	*In.*	*In.*
Cape Race, Newfoundland	99												
Sydney, Cape Breton Island	48	30.06	30.11	+0.23	25.9	−0.3	35.6	16.3	48	−3	2.85	−2.08	16.5
Halifax, Nova Scotia	88	29.85	29.96	+.02	29.3	+.3	36.2	22.4	48	4	4.10	−1.36	17.5
Yarmouth, Nova Scotia	65	30.01	30.08	+.13	32.1	+1.3	38.8	25.4	49	10	3.65	−1.35	16.6
Charlottetown, Prince Edward Island	38	30.03	30.07	+.17	26.0	+.6	33.4	18.7	47	2	3.66	+.45	24.1
Chatham, New Brunswick	28	29.96	30.00	+.10	21.4	−1.6	32.4	10.4	46	−12	2.91	−.56	10.3
Father Point, Quebec	20	30.04	30.07	+.17	21.5	+1.2	28.2	14.8	40	15	3.05	+.32	30.1
Quebec, Quebec	296	29.79	30.14	+.18	20.9	−.3	27.7	14.1	41	−5	3.80	+.54	28.4
Doucet, Quebec	1,236				9.6		24.6	−5.5	45	−46	2.49		24.5
Montreal, Quebec	187												
Ottawa, Ontario	236	29.86	30.14	+.13	23.5	+2.0	32.5	14.5	47	−8	4.99	+2.27	16.4
Kingston, Ontario	285	29.80	30.13	+.12	26.2	+.6	32.7	19.8	50	−1	2.52	−.12	4.0
Toronto, Ontario	379	29.72	30.15	+.13	28.0	+.7	34.7	21.3	53	1	2.67	+.03	10.8
Cochrane, Ontario	930				12.5		22.9	2.1	44	−26	1.40		13.4
White River, Ontario	1,244	28.69	30.07	+.04	10.2	−2.0	24.3	−4.0	42	−46	2.60	+1.22	26.0
London, Ontario	808				25.2		33.0	17.5	57	−2	2.79		6.3
Southampton, Ontario	656	29.38	30.13	+.10	22.0	−2.7	29.5	14.6	46	−7	2.64	−.01	11.8
Parry Sound, Ontario	688	29.39	30.13	+.11	21.4	+.3	29.5	13.4	44	−14	3.41	+1.18	22.4
Port Arthur, Ontario	644	29.35	30.08	+.03	18.0	+1.2	26.4	9.7	49	−12	.68	−.29	6.3
Winnipeg, Manitoba	760	29.27	30.15	+.06	14.4	+2.1	24.5	4.3	44	−19	1.18	+.15	9.1
Minnedosa, Manitoba	1,690	28.24	30.14	+.08	16.8	+4.3	26.8	6.8	44	−12	.17	−.48	1.7
Le Pas, Manitoba	860				9.4		21.9	−3.0	44	−22	.23		2.3
Qu'Appelle, Saskatchewan	2,115	27.74	30.06	+.02	23.2	+8.3	32.7	13.6	56	−7	.37	−.40	2.2
Moose Jaw, Saskatchewan	1,759				26.2		35.8	16.7	61	−6	.37		2.4
Swift Current, Saskatchewan	2,392	27.48	30.09	+.07	27.1	+5.1	36.4	17.9	57	−13	.51	−.30	4.9
Medicine Hat, Alberta	2,365	27.52	30.06	+.06	29.9	+2.4	39.1	20.7	66	−7	1.29	+.53	11.2
Calgary, Alberta	3,540	26.33	30.12	+.17	27.6	+1.4	36.7	18.6	66	1	1.42	+.70	14.2
Banff, Alberta	4,521	25.38	30.07	+.13	29.3	+9.1	38.6	20.0	53	3	1.04	−.37	9.7
Prince Albert, Saskatchewan	1,450	28.52	30.17	+.09	16.4	+4.4	27.3	5.6	53	−23	.81	+.04	7.9
Battleford, Saskatchewan	1,592	28.34	30.15	+.09	22.6	+9.5	31.8	13.4	54	−12	.32	−.14	2.9
Edmonton, Alberta	2,150	27.77	30.13	+.17	26.2	+2.0	34.4	17.9	64	−3	.88	+.16	4.1
Kamloops, British Columbia	1,262	28.80	30.12	+.20	41.2	+5.1	50.9	31.5	64	23	1.06	+.49	5.0
Victoria, British Columbia	230	29.85	30.11	+.14	48.7	+6.8	54.6	42.8	63	37	4.12	+1.00	.0
Barkerville, British Columbia	4,180												
Estevan Point, British Columbia	20				46.0		5.13	40.8	56	33	8.31		.0
Prince Rupert, British Columbia	170				41.3		47.9	34.6	63	26	8.10		3.0
Hamilton, Bermuda	151												

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Cochrane, Ontario	930				−7.4		4.7	−19.5	28	−36	1.18		11.8
Port Arthur, Ontario	644	29.46	30.22	+.17	5.0	−1.4	15.5	−5.5	38	−29	.34	−.56	3.4
Banff, Alberta	4,521	25.43	30.19	+.21	22.6	+3.4	32.7	12.4	44	−25	.22	−.70	1.4
Edmonton, Alberta	2,150	27.76	30.13	+.11	21.9	+13.6	31.4	12.5	52	−25	.56	−.11	5.6
Kamloops, British Columbia	1,262	28.86	30.19	+.23	31.7	+3.4	38.4	25.1	57	11	.09	−.70	.0
Estevan Point, British Columbia	20				44.8		50.7	38.9	54	30	6.98		.0

SEVERE LOCAL STORMS, MARCH 1934

[Compiled by Mary O. Souder]

[This table herewith contains such data as have been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path (yards)	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Gordo, Ala., southwest to northeast of.	2		100		$2,000	Tornadic winds	3 persons injured; property damaged; path 2 miles long.	Official, U.S. Weather Bureau.
Hill County, Mont	2					Gale	Damage to plowed fields by soil blowing	Do.
Chattanooga, Tenn., and vicinity.	3					Flood	Previous heavy rains caused flooding conditions; families in lowlands forced to move out.	Do.
Albany (near), Ga	4				5,000	Wind	Several buildings demolished; considerable amount of lumber destroyed.	Do.
South Dakota, entire State	4	P.m.				Wind and dust	Due to long-continued drought and barren fields, wind caused much blowing of soil.	Do.
Golden, Colo., and vicinity	5	A.m.				Wind	Property damage amounting to thousands of dollars.	Do.
Roswell, N.Mex	5					do	House unroofed; windmill blown down; roof taken off instrument shelter.	Do.
South Dakota, eastern portion of State.	5	8 a.m.–8 p.m.				Wind and dust	Severe duststorm; much blowing of soil	Do.
Superior, Ariz	8				5,000	Wind	Buildings and trees damaged; wind velocity of 84 miles per hour recorded.	Do.
La Villa-Mercedes, Tex	14	3–5 p.m.	[1] 5			Hail	Severe damage to tomato crop, other crops also damaged; some property damage; no estimate of loss given; path 28 miles long.	Do.
South Dakota, entire State	16	7 a.m.–7 p.m.				Dust and gale	Unusually severe duststorm; lights required in early afternoon; visibility at times less than 50 yards; motorists and traffic moved slowly.	Do.

[1] Miles instead of yards.

SEVERE LOCAL STORMS, MARCH 1934—Continued

Place	Date	Time	Width of path (yards)	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Cottage Grove, near, Wis	17	2:45 a.m.	38-75		1,300	Tornado	Automobile lifted from the ground and a water tank wedged underneath it; farming implements damaged; storm confined to 1 farm.	Official, U.S. Weather Bureau.
Canal Point, Fla	17	5:15 p.m.	300			Heavy hailstorm	Damage to crops amounted to several hundred dollars.	Do.
Springfield, Mo	17	5:50-11:45 p.m.				Heavy sleet	Storm worst of entire winter; traffic greatly hampered; minor accidents numerous.	Do.
Fort Wayne, Ind	17	P.m.				Electrical and heavy rain.	Windows in 14 houses shattered and 1 person rendered unconscious by lightning; child injured by flying glass.	Do.
Arcadia, Fla	17		880			Hail	Most severe hailstorm ever experienced in this locality; little damage to property.	Do.
Nashville, Tenn	19	4 a.m.-5:30 p.m.			275,800	Rain, sleet and glaze.	The weight of glaze which formed on all exposed objects caused telephone poles and many trees to fall; many communities without electricity; worst storm in history of the station; coating of sleet and ice on the ground about an inch thick.	Do.
Madison County, Fla	19	11 a.m.			1,500	Scattered wind squalls.	Property damaged	Do.
Evansville, Ind	23				1,000	Glaze	Details of damage not given	Do.
Memphis, Tenn	23					Electrical	Lightning caused much damage to power and light lines and set fire to several houses.	Do.
Pitkin, La	26	3:30 a.m.	17		5,000	Tornadic winds	Property damaged; path 300 yards long	Do.
Ville Platte, La., 7 miles west	26	4:15-4:40 a.m.	[1] 2		1,000	Thundersquall	Several barns blown over; roof blown off; path 4 miles long.	Do.
Tallulah, La	26	7 a.m.			17,000	Tornadic winds	A cotton warehouse demolished and other buildings damaged; path several hundred yards wide and about 440 yards long.	Do.
New Orleans, La., eastern portion.	26	8:05-8:10 a.m.	33-66		150,000	Tornado	Telephone and electric wires and poles torn down; 15 persons injured; 60 houses demolished and 50 damaged; path 4 miles long. For further details see article in the Monthly Weather Review, this issue.	Do.
Cheyenne, Wyo	26	A.m.				Snow and glaze	Moist snow and heavy mist froze causing glaze to form; walking hazardous; some damage to wire systems.	Do.
Chicago, Ill	26					Snow	Slippery streets hampered traffic; driving hazardous.	Do.
Springfield, Ill	26					Snow and sleet	Traffic conditions hazardous; streets slippery and walking difficult.	Do.
Fort Wayne, Ind	26				10,000	Rain, sleet, and glaze.	Glaze remained on trees and wires for 2 days	Do.
Madison, Delaware, Blackford, and Grant Counties, Ind.	26-27	A.m.			125,000	Glaze	Damage to transportation and power lines estimated to be $125,000; large limbs of trees broken.	Do.
Detroit, Mich	26-27					Heavy snow and sleet.	9.8 inches of snow and sleet, heaviest 24-hour snowfall since December 1929; traffic delayed; streets slippery; trains 1 to 2 hours late; busses stalled on streets and roads leading to Detroit.	Do.
Ohio, northern half of State	26-29					Glaze	Considerable damage to telephone and power lines and to trees; streets and walks exceedingly icy and slippery, greatly delaying traffic; many accidents to pedestrians and motorists.	Do.
Indianapolis, Ind	27	A.m.				do	Much damage to power and telegraph wires and poles; service and traffic delayed.	Do.
South Dakota, eastern portion of State.	27-28					Wind and dust	High winds caused severe dust storms; farmers unable to work in fields; blowing of soil caused injury to rye crop; much labor and expense involved in cleaning up after the storm	Do.
Denver, Colo	29	11:45 a.m.		1		Electrical	1 person killed by lightning	Do.
Belle Glade, Fla	29					Heavy rain	2,500 to 3,000 acres of beans washed out	Do.
Charles City, and Dubuque, Iowa.	29-30					Glaze	⅛ to ¼ inch of ice formed on pavements, trees, wires, and walls.	Do.
Winona, Minn	29-31					Snow	18 inches of snow fell, this being twice as heavy as the previous fall this winter.	Do.
Clearwater County, Idaho, southwestern portion.	30	5:30 p.m.				Hail	Damage not estimated	Do.
Madison (near), Fla., and vicinity.	30	6 p.m.			600	Heavy hail	Loss to crops; 5 hogs and many birds killed; windows broken.	Do.
Cocoa, near, Fla	31	8:30 p.m.				do	Heavy hail both sides of Indian River north and south of Cocoa; large crop damage; small fowls killed and young citrus trees injured.	Do.

SEVERE LOCAL STORMS, FEBRUARY 1934 (SUPPLEMENTARY TABLE)

Place	Date	Time	Width of path (yards)	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Conway, S.C	10			1		Sleet and ice	Ice-coated windshield caused the death of 1 man	Official, U.S. Weather Bureau.
Greenville, S.C	25	8 p.m.			$5,000	Wind	Telegraph and telephone poles, weighted with glaze, blown down.	Do.
Union, S.C	25	P.m.			3,000	do	Damage to several chimneys and roofs	Do.
Iva, S.C	25				5,000	Thundersquall	Store windows blown in, chimneys blown down; roofs damaged; trees uprooted.	Do.
Saylor's Cross Roads, S.C	25				2,000	do	Barn and garage on 1 farm and 3 outbuildings on another wrecked, or partly so.	Do.
Anderson, S.C., northeast within the State.	25-26				30,000	Wind	Considerable number of poles and wires, weighted with ice, blown down.	Do.
Luray, S.C	26	4 a.m.			2,000	do	Dwelling blown down and the 2 occupants slightly injured.	Do.

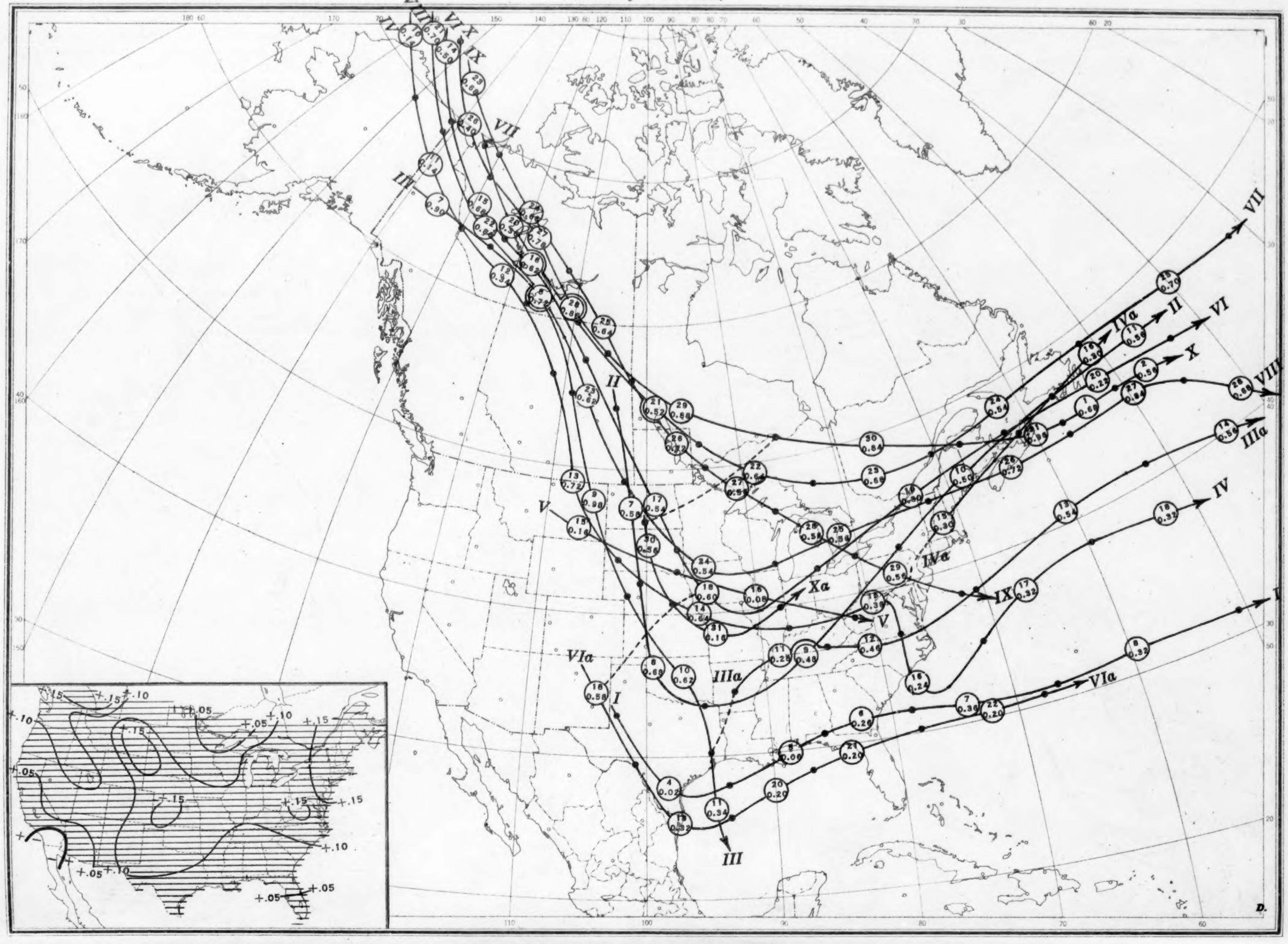
[1] Miles instead of yards.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, March 1934

Chart I. Departure (°F.) of the Mean Temperature from the Normal, March 1934

Chart II. Tracks of Centers of Anticyclones, March 1934. (Inset) Departure of Monthly Mean Pressure from Normal

(Plotted by G. E. Dunn)



Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

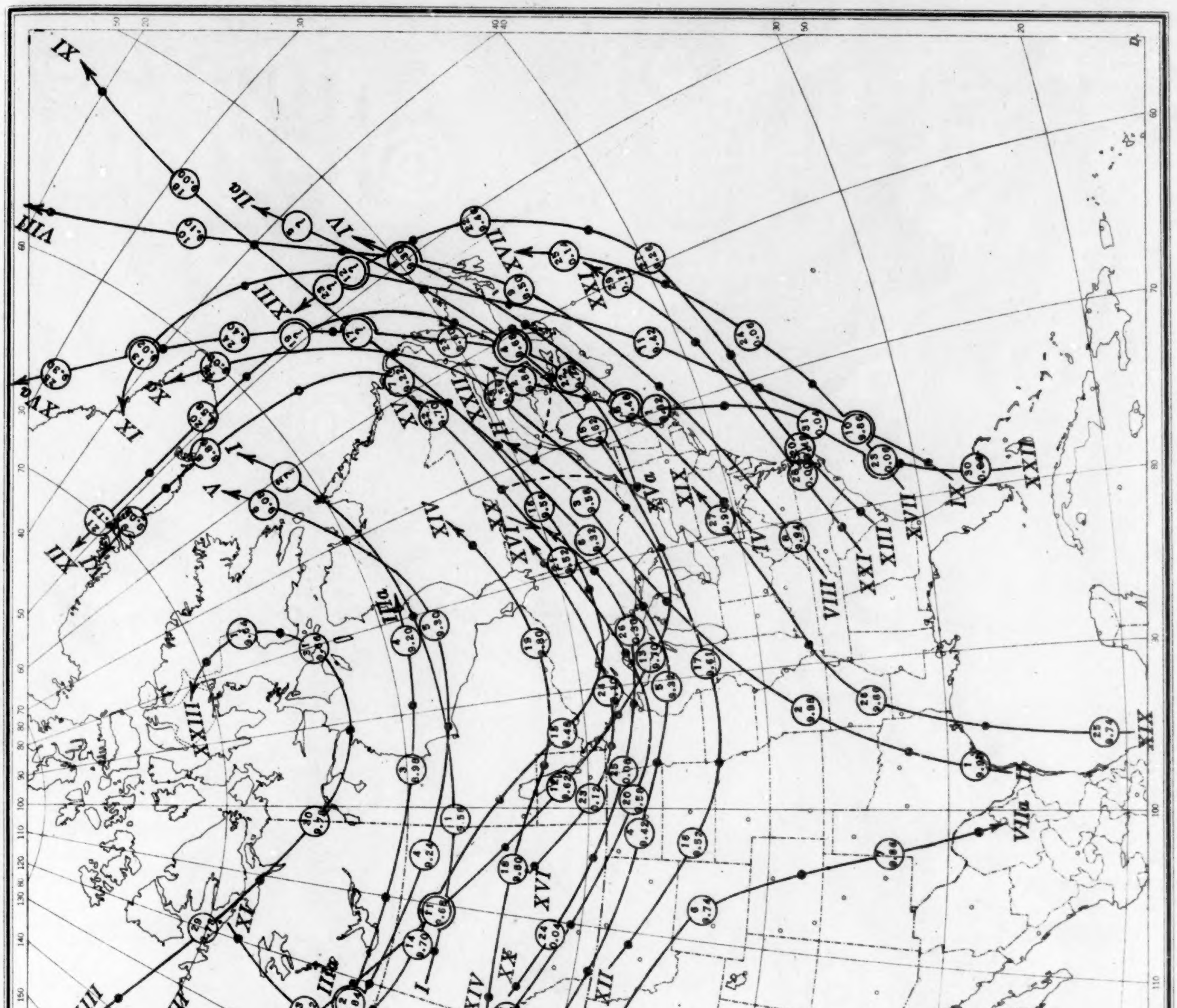
Chart III. Tracks of Centers of Cyclones, March 1934. (Inset) Change in Mean Pressure from Preceding Month

(Plotted by G. E. Dunn)

Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, March 1934. (Inset) Change in Mean Pressure from Preceding Month

(Plotted by G. E. Dunn)



Circle indicates position of cyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 8 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky between Sunrise and Sunset, March 1934

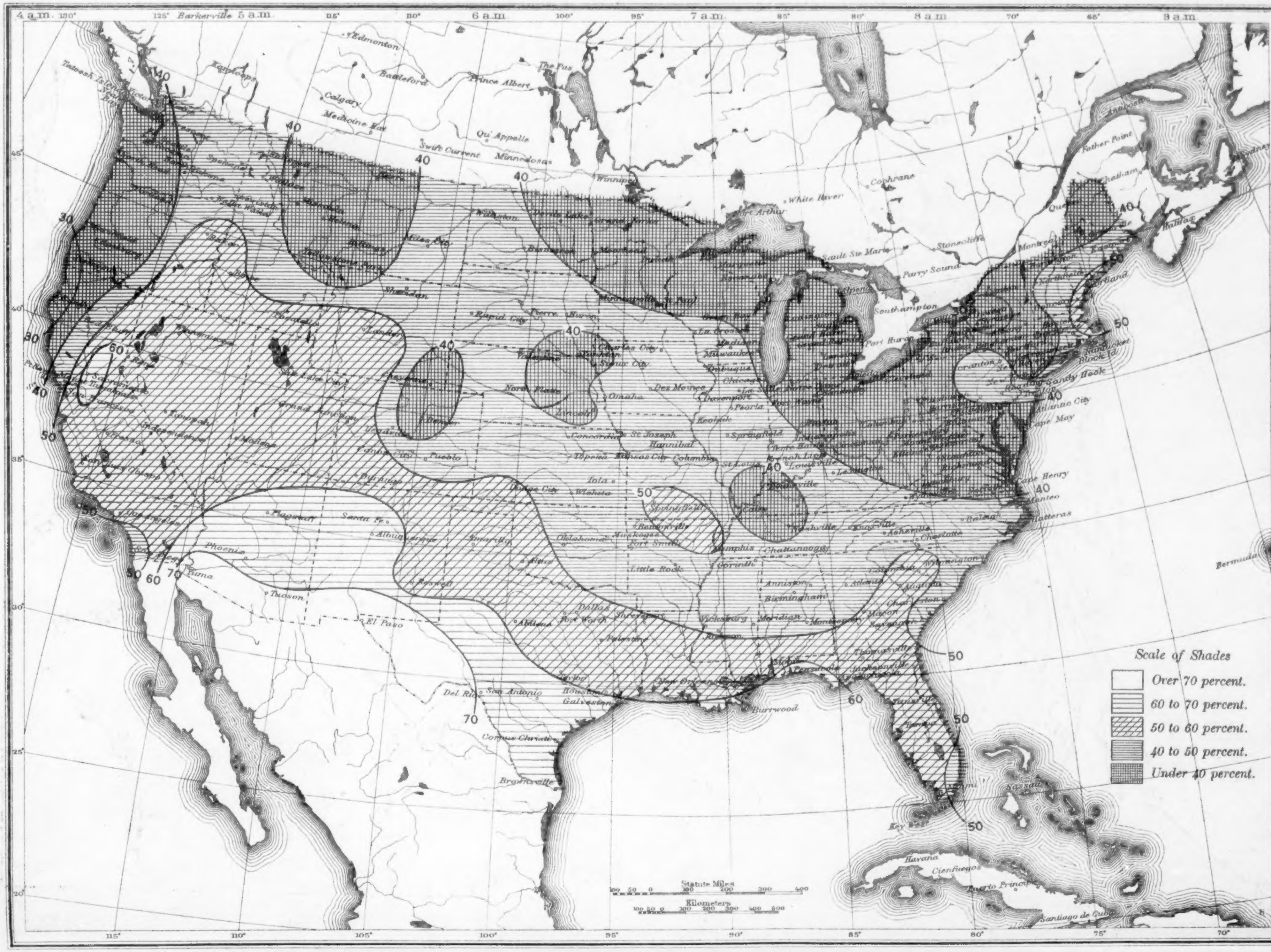


Chart V. Total Precipitation, Inches, March 1934. (Inset) Departure of Precipitation from Normal

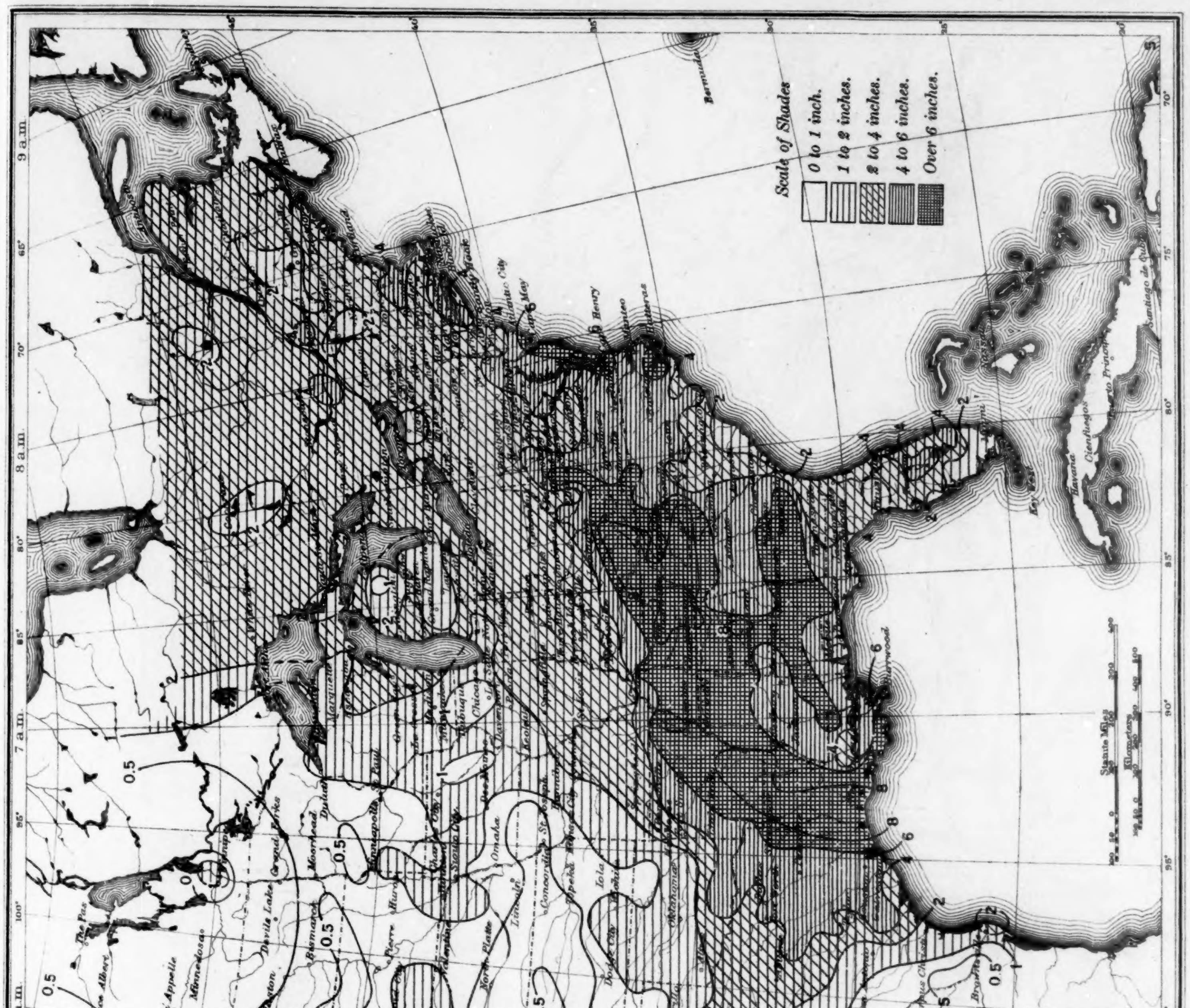


Chart V. Total Precipitation, Inches, March 1934. (Inset) Departure of Precipitation from Normal

Chart VI. Isobars at Sea level and Isotherms at Surface; Prevailing Winds, March 1934

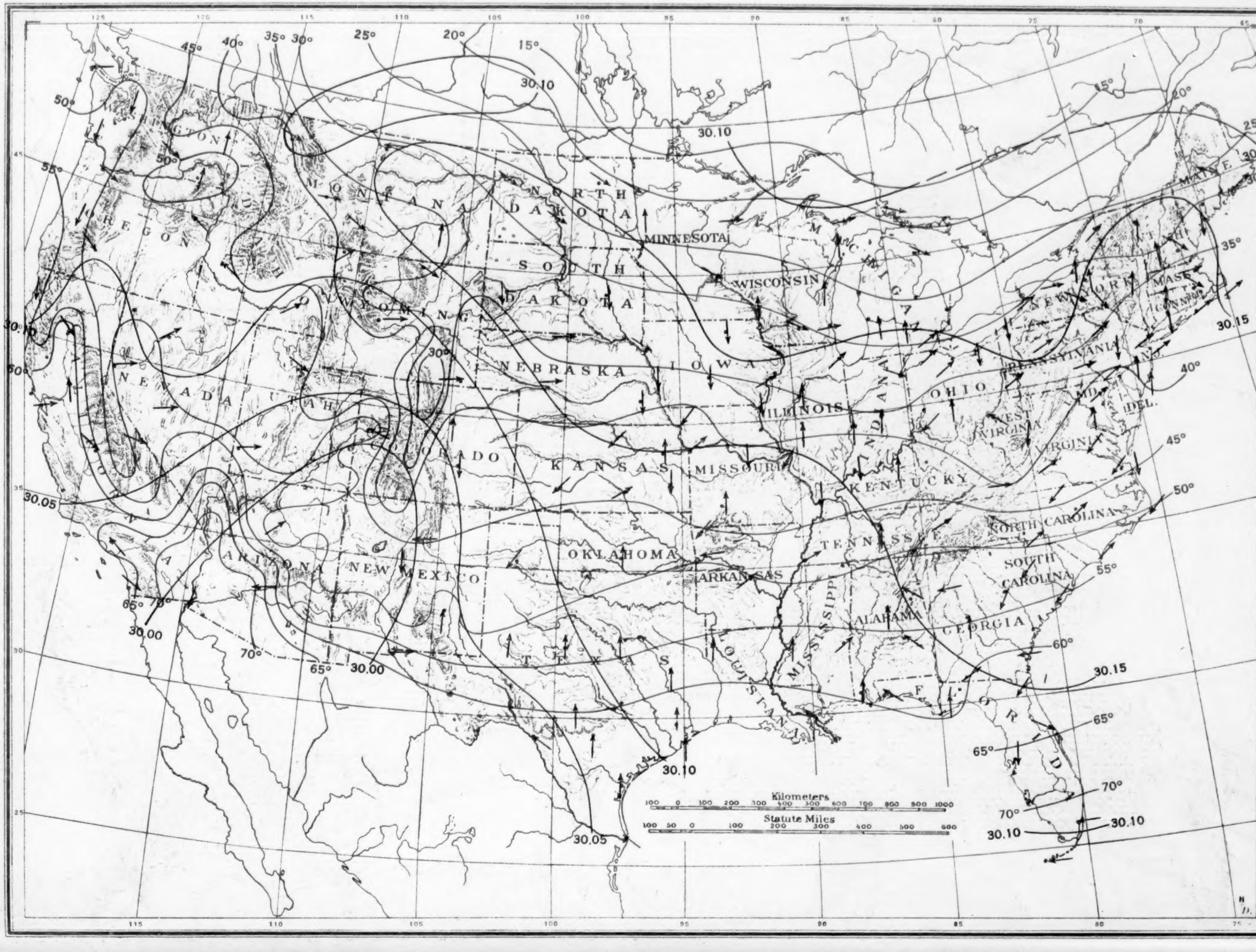


Chart VII. Total Snowfall, Inches, March 1934. (Inset) Depth of Snow on Ground at 8 p. m., Monday, March 26, 1934

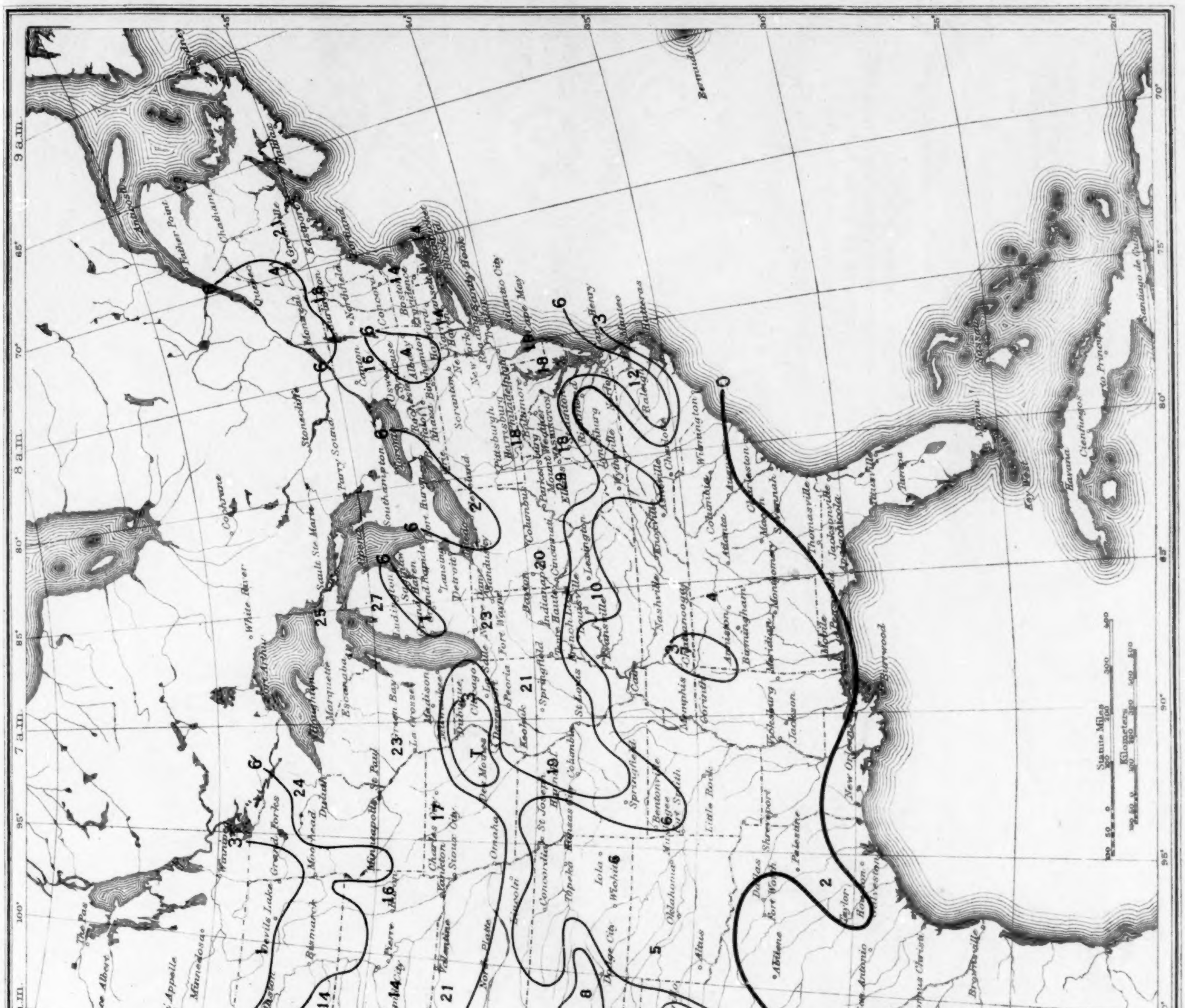


Chart VII. Total Snowfall, Inches, March 1934. (Inset) Depth of Snow on Ground at 8 p. m., Monday, March 26, 1934

Chart VIII. Weather Map of North Atlantic Ocean, March [illegible], 19[illegible]
(Plotted from the Weather Bureau Northern Hemisphere Chart)

Chart VIII. Weather Map of North Atlantic Ocean, March 5, 1934
(Plotted from the Weather Bureau Northern Hemisphere Chart)

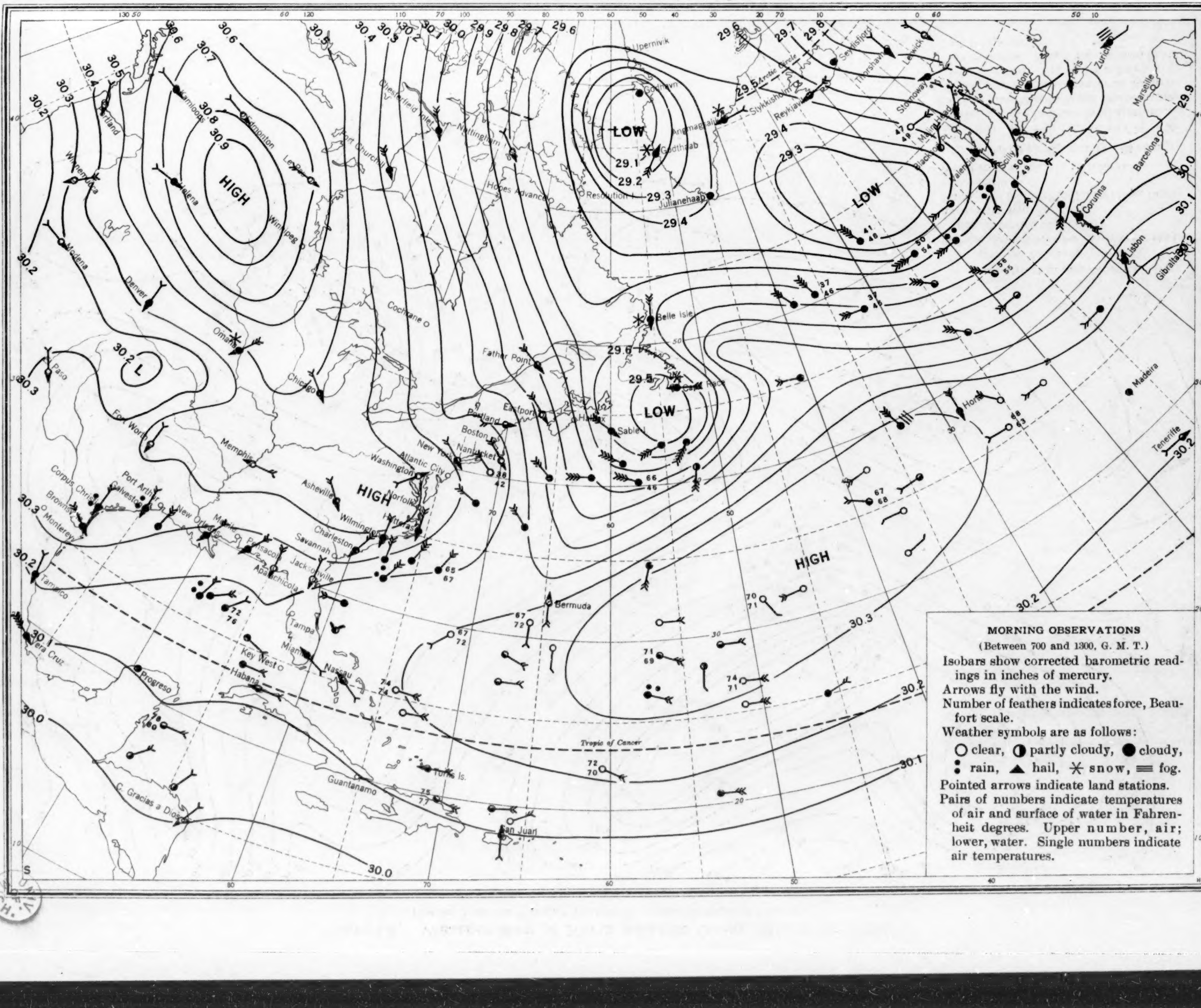


Chart IX. Weather Map of North Atlantic Ocean, March 10, 1934

(Plotted from the Weather Bureau Northern Hemisphere Chart)

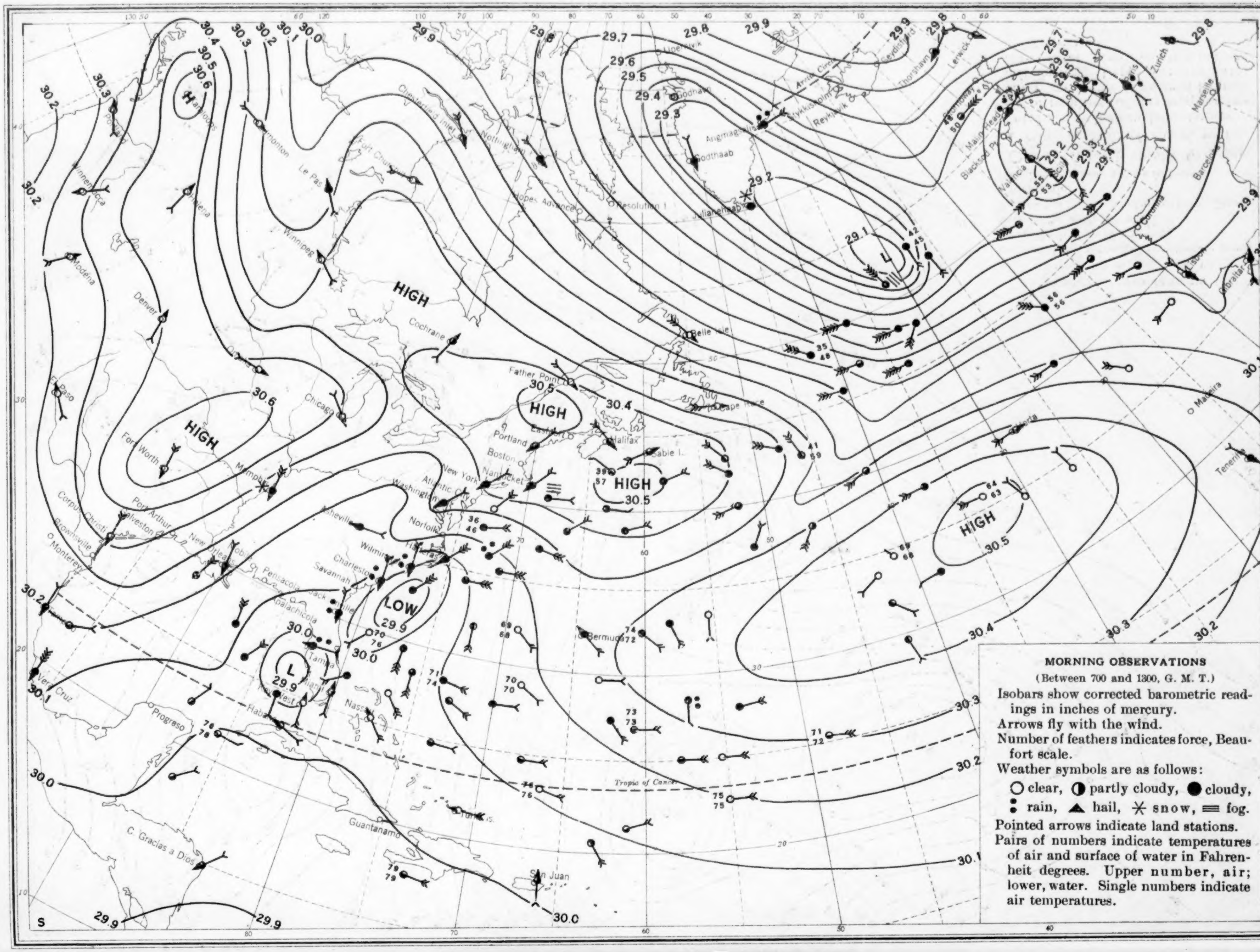


Chart X. Weather Map of North Atlantic Ocean, March 11, 1934

(Plotted from the Weather Bureau Northern Hemisphere Chart)

Chart X. Weather Map of North Atlantic Ocean, March 11, 1934
(Plotted from the Weather Bureau Northern Hemisphere Chart)

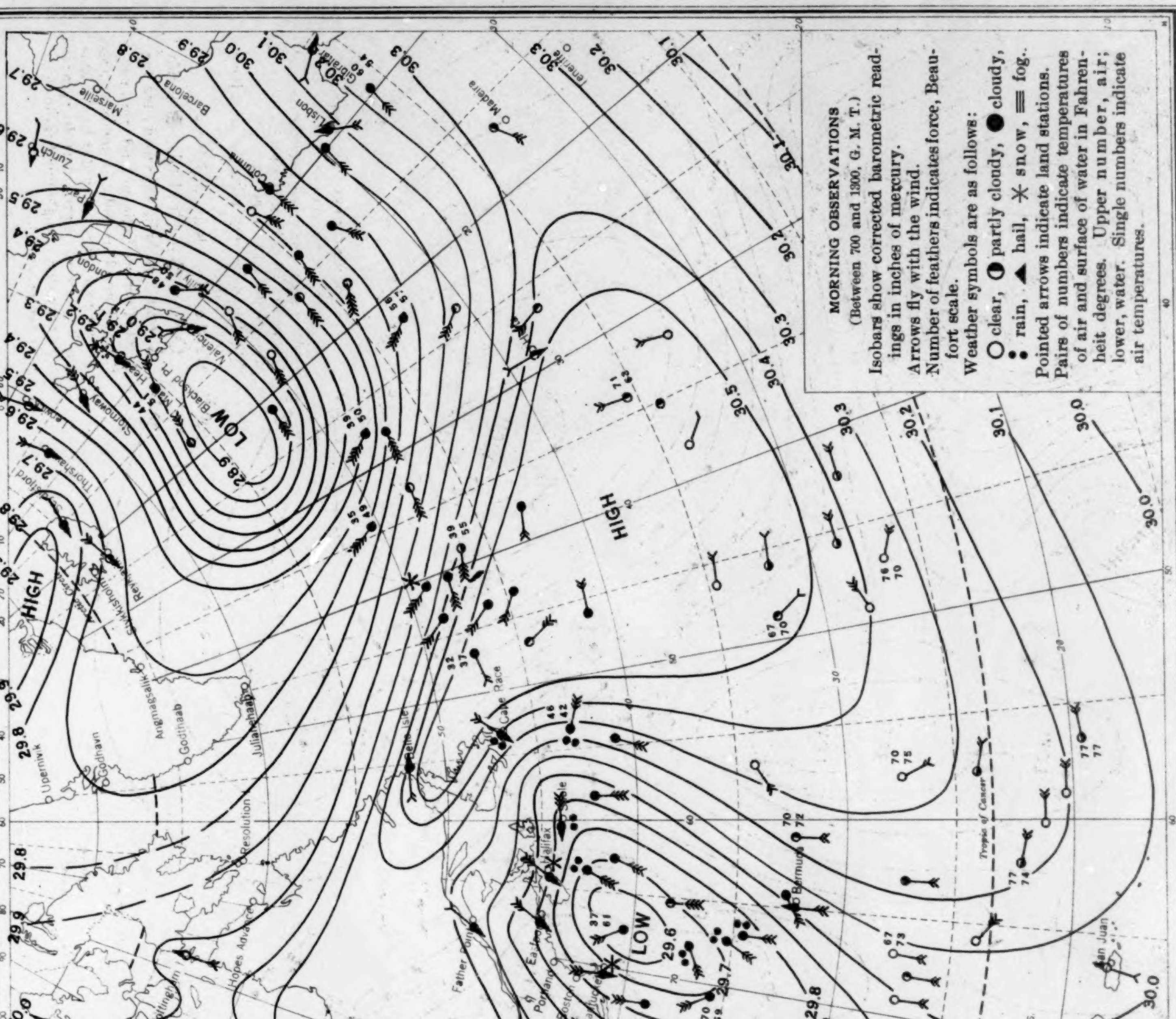
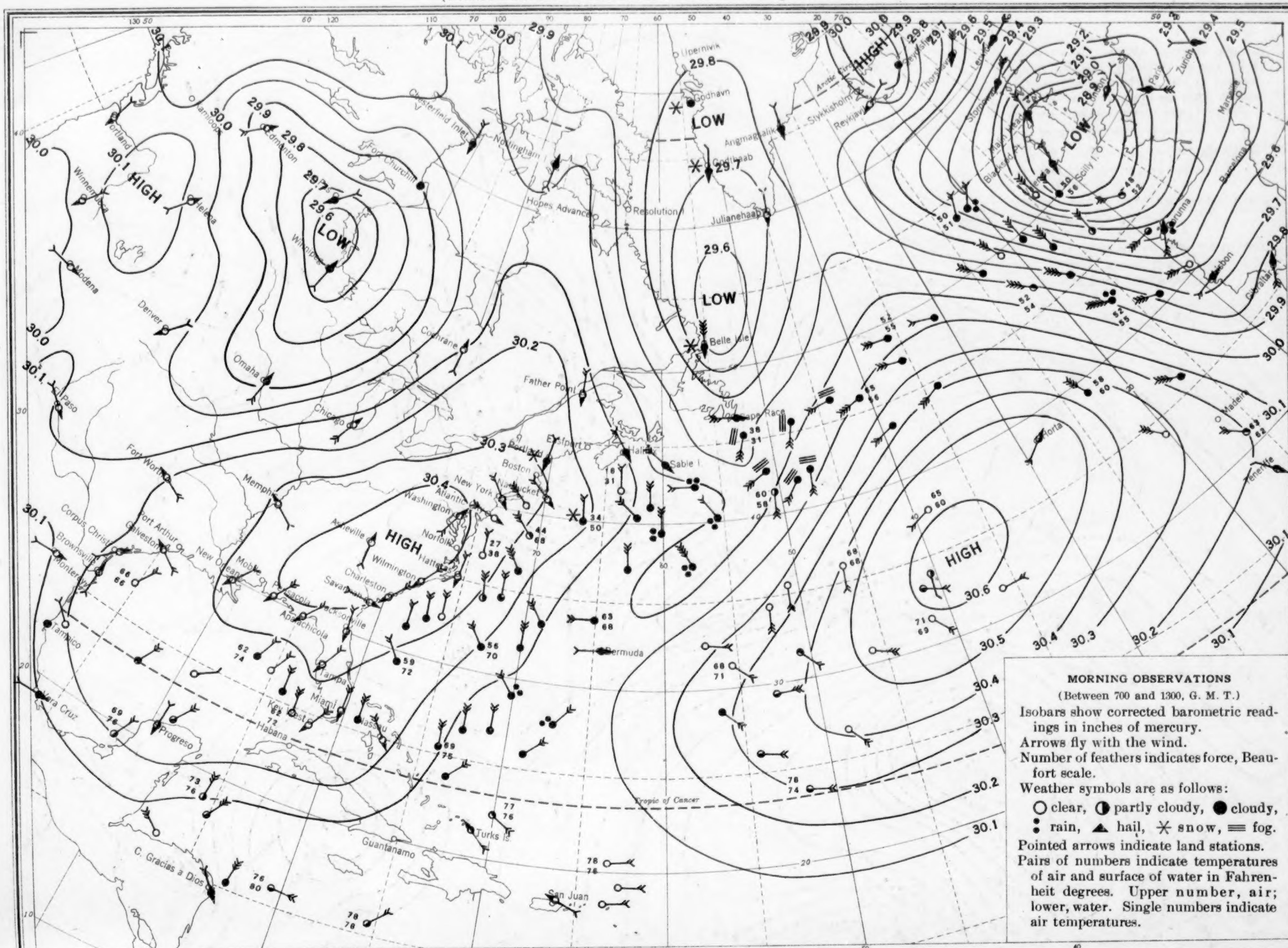


Chart XI. Weather Map of North Atlantic Ocean, March 12, 1934

(Plotted from the Weather Bureau Northern Hemisphere Chart)



MORNING OBSERVATIONS

(Between 700 and 1300, G. M. T.)

Isobars show corrected barometric readings in inches of mercury.
Arrows fly with the wind.
Number of feathers indicates force, Beaufort scale.
Weather symbols are as follows:
○ clear, ◐ partly cloudy, ● cloudy, ⁝ rain, ▲ hail, ✳ snow, ≡ fog.
Pointed arrows indicate land stations.
Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water. Single numbers indicate air temperatures.